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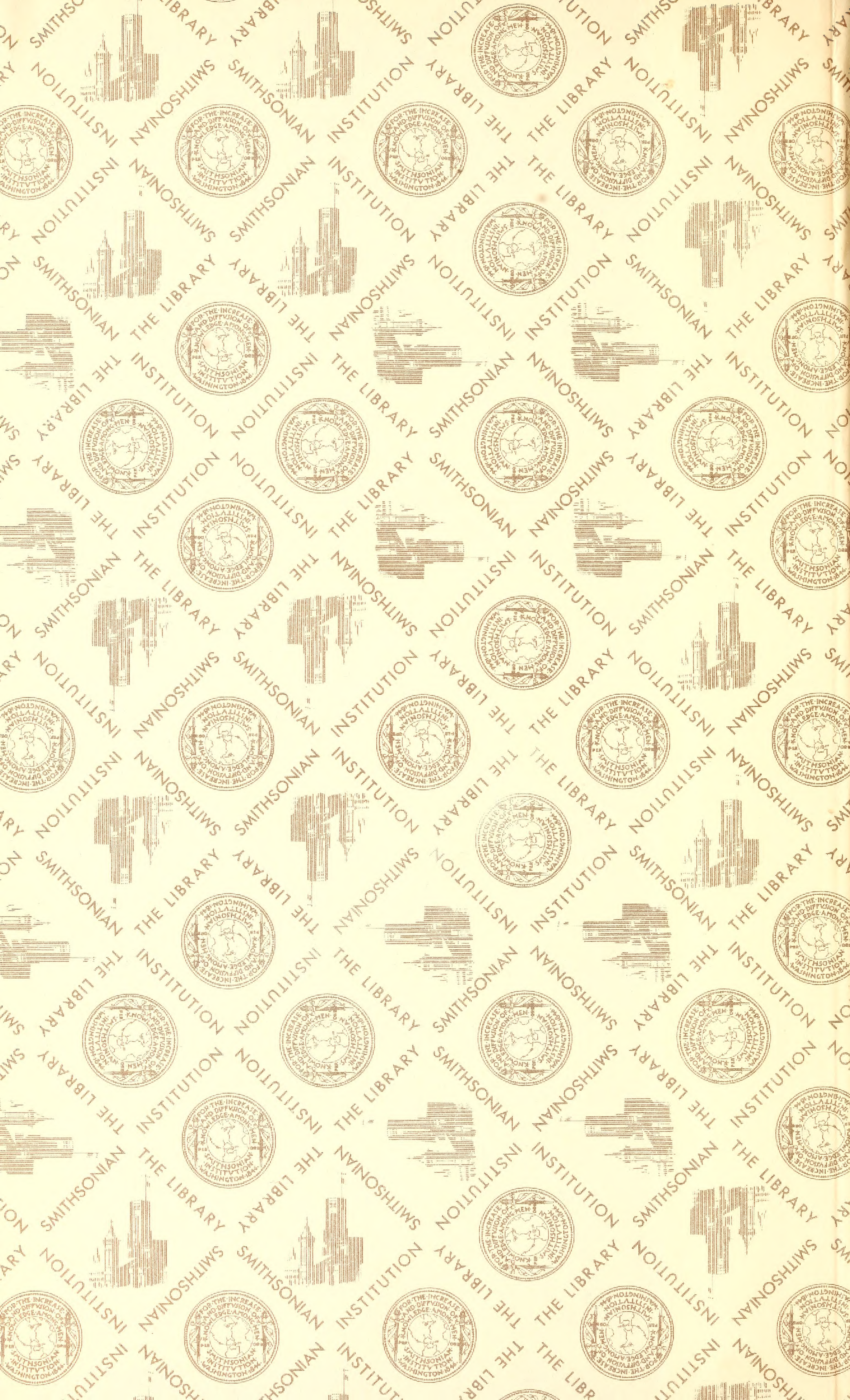
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ERRATA

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Page 585, line 14 for *Lycæne* read *Lycæna.*
,, 688 ,, 9 from bottom for *phillipinus* read *philippinus.*
,, 688 ,, 11 ,, ,, ,, *Rhiphidura* read *Rhipidura.*
,, 689 ,, 7 for *craytal* read *raytal.*
,, 692 ,, 44 *for* **Dendroocitta** *read* **Dendrocitta.**
,, 696 ,, 37 ,, **Acrocephalcus** *read* **Acrocephalus.**
Plate opp. p. 696, fig. 1 for *Kippolais* read *Hippolais.*
Page 698 line 1 *for* **langiuda** *read* **languida.**
,, 700 ,, 47 ,, **ceottoides** *read* **cettoides.**
,, 819 ,, 44 for *Calophaps* read *Chalcophaps.*
,, 819 ,, 57 ,, *Gennœs* read *Gennœus.*
,, 870 ,, 9 from bottom *for* Barkhaw *read* Barkhan *and for* Fort
Sandeman District *read* Loralai District.
,, 877 ,, 44 *for* **Lynx** *read* **lynx.**
,, 881 ,, 23 ,, **Toccacua** *read* **Taccocua.**
,, 988 ,, 31 ,, **Lanuis** *read* **Lanius.**
,, 1001 ,, 8 from bottom *for* **Hororins** *read* **Horornis.**
,, 1006 ,, 20 *for* **Hierauetes** *read* **Hieraetus.**
,, 1029 ,, 20 ,, mature *read* immature.

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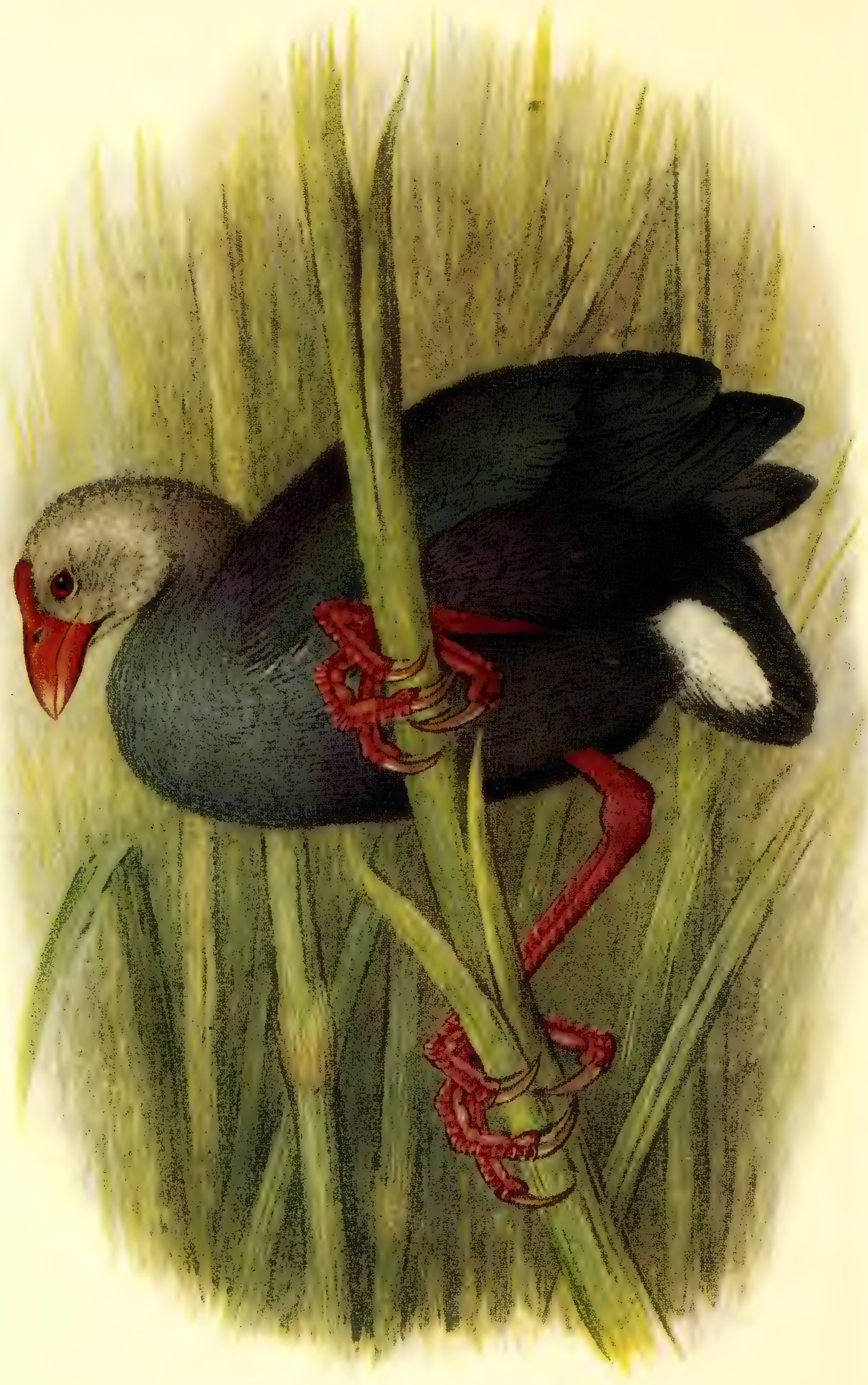

THE PURPLE COOT
Porphyrio p. poliocephalus
⅓ life size

JOURNAL
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NOVEMBER, 1926 VOL. XXXI No. 3

THE GAME BIRDS OF THE INDIAN EMPIRE

BY

E. C. STUART BAKER, F.Z.S., F.L.S., M.B.O.U,, C.F.A.O.U.

VOL. V

THE WADERS AND OTHER SEMI-SPORTING BIRDS

PART II

(*With a coloured Plate*)

(*Continued from page 238 of Vol. XXXI*)

PORPHYRIO POLIOCEPHALUS POLIOCEPHALUS

The Indian Purple Moorhen

Gallinula poliocephala Lath., Ind. Orn. Suppl., p. 68 (1801), (India).

Porphyrio poliocephalus. Blanf. and Oates, Avifauna B. I., iv, p. 178; Oates in Hume's Nests and Eggs, 2nd ed., iii, p. 384; Sharpe, Cat. B. M., xxiii, p. 197.

Vernacular names—Kaim, *Kalim*, *Kharim*, *Khima* (Hin.), *Nila boli-kodi* (Tel.); *Kittala* (Cing.); *Indura kukula* (do. South Province); *Sannary* (Tam. Ceylon); *Kaim-Sorai* (Assam); *Dao-di Gatang-lili* (Cachari). *Lila Jal al-kauri* (Sylhet).

Description.—Lores and upper part of the head pale dingy grey-brown changing into deep purple blue on the rest of the upper plumage; tail black with green reflections; exposed portions of the wings and scapulars greenish blue; the outer primaries more blue, the innermost secondaries centred darker bronze green which shows up more as the blue-green edges become abraded; sides of the head grey tinged with cobalt blue; chin, throat and foreneck dull, pale cobalt blue grading into darker greenish blue on the breast; abdomen and flanks purple showing obsolete pale edges, often absent; vent blackish brown; under tail coverts white.

Measurements.—Wing 244 to 271 mm.; tail 82 to 108 mm.; tarsus 88 to 90 mm.; culmen 41 to 49 mm. Unlike most of our water-birds the female of this moorhen is quite as big as the male and the largest measurements given above refer in each instance to a female.

Colours of soft parts.—Iris deep blood-red, more brown-red in females and young birds; bill and casque blood red-brown, generally paler at the tip and more brown in the centre of the casque and the centre of the lower mandible; legs and feet pale dingy-red to dull red, browner at the joints; claws dull red, darker at the tips.

Female like the male but with a smaller casque.

Young in down black with white shafts to the down of the head and wings. Bill green at the tip, blackish at the base.

Distribution.—Throughout the plains of India, Burma and Ceylon, wherever there are swamps, lakes and sufficient water. In Mesopotamia and Baluchistan our Indian bird is replaced by a very closely allied race *P. p. seistanicus ;* this form may possibly be found later on within the limits of this work. In the Malay Peninsula *P. p. edwardsi* takes the place of our bird. In this race the wings and upper plumage are dark bronze green-brown and possibly its status should be that of a species rather than a sub-species.

Nidification.—The Purple Moorhen breeds practically all over India and Ceylon wherever there are suitable large swamps and Jheels with plenty of cover. The time during which they breed depends entirely on the rainfall. Wherever, as in the north-east of India, the rains break about the middle of June, the birds will be found commencing nesting operations a few days after the first heavy rainfall. In Bengal and Assam I have found nests as early as the first week in July and as late as the last week in September, both containing fresh eggs. In north-west India I think most birds start rather later and few nests will be found before August, whilst in Ceylon it is said to breed principally in February, March and April.

The situation for the nest varies very considerably, most of those I have personally found have been large structures of reeds and grass mixed with a little water-weed and curiously enough very often having the wettest weeds on the top of the nest. The materials are fairly well put together but they are very untidy nests with odds and ends of rushes, etc., sticking out in every direction. The favourite site for these bulky rush nests is in amongst the tangled masses of reeds which grow in clumps here and there in all the Bengal and Assam swamps. Where the birds are especially numerous as, for instance, in Sylhet and N. Lakhimpur, I have sometimes seen five or six nests in one of these clumps, placed not a dozen yards from one another. On the other hand, where the birds are less common each pair usually occupies one of these clumps to the exclusion of all other birds.

Another common site for the nest is on the curious floating islands of weed that one sees almost everywhere in India and Burma. So matted are these weeds that they will often bear the weight of a man walking over them so long as he does not attempt to stop for more than a second or two in any one place. The leaves and flowers of this weed grow up above the level of the water for a few inches and afford quite sufficient cover for the Purple Moorhen's nest, but when placed on these floating islands it is generally a very much smaller affair than when built on broken reeds. As a rule it is made principally of dead and, sometimes, very evil smelling leaves of water plants and upon these are placed a layer of rush blades and grass over which again other weeds form the actual bed on which the eggs are laid.

Occasionally a nest may be built on the banks which divide rice fields from one another and when so placed they are well hidden in the dense herbage which almost invariably covers the banks. One such nest which I took in North Lakhimpur was composed entirely of young rice stems which the birds had pulled up by their roots and massed into a small, snug nest measuring barely six inches in diameter.

Yet a further site of which these birds sometimes make use is the flat top of a dense shrub which grows all round the edges of the swamps in the cold season and is nearly submerged when the rains are at their height.

The making of the nests seems to be a matter of only two or three days for I have worked a piece of ground at the beginning of the week finding no nests at all and at the end of the same week have found nests built and in some cases two or three eggs laid. As far as it is known at present, the female bird alone actually makes the nest. I watched a pair once for some time while nesting operations were going on and although both birds seemed to pick up weeds, rushes, etc., only one bird ever went in to the patch where the nest was being built whilst the other, presumably the cock, after paddling and climbing about for a short time with his mouth full of the material he had gathered, invariably dropped it and forgot all about what he had originally got it for.

The eggs vary very much in number, sometimes only three are laid and incubated whilst at other times it is said to lay as many as nine. Four or five, however, form the normal clutch, three, six or seven being about equally often found.

In appearance the eggs are very much like large Moorhen's eggs but on the whole are more richly coloured and better marked. The ground colour varies from a pale pinkish or yellowish-stone to a rich warm buff or reddish-buff, whilst the markings consist of small blotches and spots varying in colour from reddish-brown to deep purple and blackish-brown. These markings are scattered lightly over the whole surface of the egg but in the great majority of cases are more numerous at the larger end though it is very exceptional for them to form anything in the nature of a cap or ring. Occasionally a clutch of eggs may be found of which the ground colour is very pale making the markings look bolder and more conspicuous. Even more rarely, the markings may consist of larger blotches and of long lines and I have seen one clutch, taken by Inglis in Behar, of which the ground colour is a deep rich buff, the markings consisting of very large blotches of reddish-brown, some of the blotches measuring over 12 mm. across.

When freshly taken the eggs are much more bright in their general tone but even in a very few days become comparatively dull and faded. In shape they are rather long ovals distinctly compressed towards the smaller end but seldom at all pointed.

The texture is fairly close and strong and when first laid there is a slight gloss which, however, soon disappears.

The natives of Assam say that the eggs take 26–30 days to incubate but I have no proof whether this is correct or not.

One hundred eggs in my own collection average 50·5 × 35·7 mm.; maxima *54·6* × 36·9 mm. and 52·1 × *37·2* mm.; minima *45·7* × 36·1 mm. and 49·3 × *34·2* mm. Practically the whole of these were taken in Northern India and it should be noted that Hartert gives the average of fifty eggs taken in South and North-West India and recorded by Hume as 48 × 35·3 mm. A few eggs, however, in my own collection taken in Ceylon and not included in the above hundred, measure almost exactly the same as the hundred.

The Purple Moorhen is undoubtedly a very handsome bird in so far as colours go but its antics when courting appear, to the human eye, extremely ludicrous. The two birds, male and female, may be either swimming or clambering about the reeds together quite quietly when suddenly he takes it into his head that it is time to show off. If swimming on the water or running over the floating weeds, he approaches his ladylove, holding in his mouth a few weeds and when within a foot or two of her, bobs his head with great emphasis about half a dozen times, uttering all the time a curious little guttural cluck. He then raises both wings and flaps them once or twice vigorously and draws himself up to his full height and once more repeats his bows. Then, as a final display, he brings both wings well forward quivering them as he does so and gives vent to a very loud sonorous chuckle or cackle. When he wishes to display whilst clambering on the reeds he goes through much the same performance, frequently, however, spoiling the dignity of the show by toppling off the reeds in the water in his final burst of energy.

As we know, with most birds the hen takes but little notice of her husband's proceedings but the female Purple Moorhen really does seem to be to some extent impressed by his carryings-on and sometimes, at all events, will follow his repeated bows with little bows of her own.

Habits.—The Purple Moorhen is essentially a bird of the plains but the only essential thing for him is sufficient water and water which must be stagnant and not running; though on occasions they may be seen on slow running rivers especially such as have weedy rush-covered banks. For some reason the Purple Moorhen has the reputation of being a shy retiring bird and a great skulker but certainly this reputation is not deserved so far as my own experience goes. Where much interfered with or shot at, these birds naturally cling to the denser cover and are then difficult to force into the open but all over Assam and the wilder parts of Eastern Bengal, they seem to spend the greater part of their time in the open and even when clambering about in the reed beds they constantly show themselves near the tops, seldom staying in them for any great length of time. One may see them sauntering about over the tops of the water reeds, idly picking here and there as they wander or sometimes half sitting on the weeds and half floating in the water, basking in the sun. Nor are they shy of human beings so that it is very easy to get a dug-out within 50 or 60 yards of them and watch them for as long as one wishes without frightening them away. They are noisy birds and have a very large repertoire of notes consisting of cacklings, cluckings and hoarse rippling notes. When feeding they also constantly utter a little soft 'chuck-chuck' to one another and, when as is generally the case, they feed in parties, each member of the party replies with a corresponding note. Moving about either in the water or over the reeds, the Purple Moorhen does not seem to be an awkward bird but when climbing about on the larger reeds its movements are extremely ungainly. It is sometimes found in reeds which are also occupied by the Indian Reed Warbler and the actions of the tiny Warbler and the huge Moorhen when climbing are curiously alike, although the former is so quick and graceful and the latter so slow and clumsy. The actions of the two have been well compared to the actions of a donkey trying to emulate the antics of a lap dog. At the same time, this Moorhen is by no means a bad climber and grasps the reeds in its huge feet, climbing up them hand over hand until the tops bend down with its weight when it either descends or flutters on to another group of stems. Although it is generally loth to take to flight it can fly at quite a fair speed when once it is well under way but it is a slow starter and flys with very laboured flaps of its wings, its long legs and huge feet hanging conspicuously below it. When a party of these birds is disturbed they generally scatter in all directions and do not, like the Common Moorhens, fly off all together in one direction. As soon, however, as the disturbing element is withdrawn, loud clucks may be heard all round and the individuals soon gather together into their original flock. The food is said to be entirely vegetarian and no doubt for the most part this is correct, but I have frequently taken small water shells and insects from their stomachs and whilst watching them have been convinced that as they pick about they constantly pick up whatever animal food may be available for them. I have never, however, taken any fish from their stomachs.

Natives consider that the Purple Moorhen and its eggs are excellent eating and possibly young birds might even suit the European palate but two which I have tried myself were very tough and coarse.

GALLICREX CINEREA

The Kora or Water-Cock.

Fulica cinerea Gmel., Syst. Nat., i, p. 702 (1789) (China).

Gallicrex cinerea Blanf. and Oates, Avifauna, B. I., iv, p. 176; Oates in Hume's Nest and Eggs, 2nd ed., iii, p. 387; Sharpe, Cat. B. M., xxiii, p. 183.

Vernacular names—Kora, *Kongra*, (Hin.); *Kettala*, (Cing. N. Ceylon); *Willi-kukulu* (S. Ceylon); *Tannir-koli* (Tam. Ceylon); *Boun-dote* (Burm.); *Khora-sorai* (Assam).

Description : adult male in breeding plumage.—Head, neck and lower plumage black, the feathers edged with pale grey except on the posterior flanks and abdomen where the edges are whiter and broader ; hind neck, back, scapulars and wing coverts blackish-brown, broadly edged with light slaty-grey ; rump and upper tail-coverts brown edged with fulvous-brown ; outer wing-coverts dark brown edged with fulvous ; quills blackish-brown, the outer web of the first primary white ; under tail coverts buff or buffy-white with brown bars and centres.

Colours of soft parts.—Iris bright red ; bill and shield at the base blood red, paling and becoming more dusky yellow at the tip; the horn projecting from the back of the casque is bright red ; legs and feet dull to bright red.

Measurements.—Wing, 211 to 227 mm. ; tail, 77 to 83 mm. ; tarsus, 75 to 77 mm. ; culmen 37 to 38 mm.

Male in non-breeding plumage.—Similar to the female.

Female.—Lores and feathers round the eye mixed dark brown and fulvous white ; crown brown faintly edged paler ; upper parts, scapulars, tail and wing-coverts dark brown broadly edged with fulvous ; quills dark brown, the outer web of the first primary white ; lower parts pale buffy-brown, nearly white on the chin, throat and centre of the abdomen, barred everywhere with wavy lines of dark brown but the bars less obvious on the whitest parts ; under tail-coverts buff, barred with blackish brown.

Colours of soft parts.—Iris yellow to yellowish-brown ; bill horny-yellow with no casque, but the small triangle running into the forehead yellowish ; legs and feet dull greenish-brown.

Measurements.—Wing, 172 to 184 mm. ; tail, 65 to 75 mm. ; tarsus, 65 to 68 mm. ; culmen, 32 to 34 mm.

Young birds are like the female but less barred below.

Chick in down : black above more brownish below.

Distribution.—The whole of India, Ceylon and Burma, wherever the country is suitable and wet enough, but especially common in Bengal, Assam, the Malabar coast and the wettest areas in Southern Burma. Outside our limits it extends practically throughout the Indo-Chinese countries, the Malay Peninsula and islands and again east through China to Japan.

Nidification.—The Water-Cock is resident and breeds practically wherever it is found as long as there is sufficient water and the breeding season like that of the Purple Moorhen, depends entirely on the rainfall. Over the greater portion of its habitat nesting operations commence in early June and eggs continue to be laid until the last week in September, but the very great majority are laid in the last week of July or the first three weeks of August. In Ceylon however, there seem to be two breeding seasons, first in January and February, during which months eggs were obtained by Jenkins, and again in July and August during which months eggs have been taken by Wait and others. The favourite breeding site is down amongst the roots of thick growths of reeds and rushes at the edge of swamps or actually standing in a few inches of water, but at other times they make their nests on and half supported by leaves of water plants where there is not much cover to screen them. They also occasionally make their nests in rice fields, not like the Purple Moorhen, on the banks but in amongst the growing rice. When placed amongst reeds the nest is often a very bulky one made principally of the softer blades of reeds and rushes mixed to a slight extent with water weeds. These nests often measure as much as 15″ across and perhaps 4″ to 6″ in depth, the depression in which the eggs are deposited being considerable. When, however, the nest is placed in rice fields or on floating plants it is much more flimsy, seldom measuring more than 8 or 9″ in diameter and is only 2 or 3″ in depth. In these instances too it is noticeable that the birds employ more water weeds in the construction of their nests though they nearly always line them with rush leaves and dry grass. The eggs number 3 to 5 but occasionally 7 or even 8 are said to be laid, although I have never seen the latter number, and undoubtedly under 5 rather than over 5 is most usual. In character the eggs are distinctly Moorhen-like but they are very much handsomer and generally very much darker. The ground colour varies from almost pure white, which is exceptional, through pale pink or yellow stone-colour, which is usual, to a deep brick pink. The markings consist of reddish-brown blotches and spots generally rather long in character. Under these are secondary markings of neutral tint and purplish-grey somewhat less numerous than the superficial markings. In the great majority of cases the markings are fairly profuse over the whole surface of the shell being only slightly more so at the larger end. In a few cases these markings are so numerous as to almost obliterate the ground colour whilst in a few others the markings are quite sparse everywhere except at the extreme larger end. The contrast between the darkest and the lightest eggs is very great. The shell is stout and rather coarse but the surface itself is very fine and in fresh eggs there is often a very considerable gloss, occasionally the gloss being very highly developed. In shape they are rather long ovals, one end decidedly smaller than the other but very seldom at all pointed. One hundred eggs average 42·2×31·0 mm.; maxima *46·6*×33·0 mm. and 43·2×*33·1* mm.; minima *38·9*×31·3 mm. and 39·5 mm. × *28·1* mm.

According to Sylhetis incubation takes 24 days.

When the nest is placed in amongst reeds the hen bird will often sit very close, but when she builds it in the open or in rice fields where there is not much cover, she sneaks away before she is spotted and whilst the observer is still at a considerable distance. If by any chance however, the observer comes suddenly on the bird on her nest she flattens herself out into the body of the nest with head stretched out in front until she becomes almost invisible, the eye alone being noticeable. Some natives have told me that they consider the cock bird to be polygamous but as far as I have been able to observe myself, this is not the case and I think that really they are always monogamous.

Habits.—Where undisturbed the Water Cock is a very familiar bird and moves about a good deal in the open but where they are much persecuted as is the case in Sylhet, Cachar and some other parts of India, they become very shy and keep much to cover. Like all the Rails it is somewhat crepuscular in its habits, and during moonlight nights it probably feeds during the greater part of them. It is very largely vegetarian in its diet, feeding a great deal on young rice when that is available and also on shoots of various water plants and on green crops when these are ripening. It however, also feeds on small molluscs and practically any living thing found on the reeds and rushes which it frequents but it never takes fish, however small, nor as far as I know does it ever eat small frogs or tadpoles.

The Water Cock for the table is not to be despised and if skinned before it is roasted, makes a very pleasant change from the everlasting *murghi* of the Indian camp life.

From the point of view of sport however, its value is negligible. Its flight is very poor and nothing like as strong or direct as that of its relations the Coot and the Moorhen. Like them it flies with rapid beating of the wings and its long legs hanging out beyond it and held very low. In its native element, however, either in the water itself or amongst the weeds which cover it, it is very efficient and although its motions are slow and dignified it is capable of running at a considerable speed over floating weeds or of making its way through the denser and more tangled cover of broken reeds. It is probably the most pugilistic of all our water fowl, the males fighting desperately through the breeding season challenging one another with a loud booming call, several notes uttered in quick succession and finishing with a much shriller one rising almost to a scream. Its fighting qualities have made this bird a great favourite with the natives of Sylhet and Cachar who keep them as fighting birds and often wager considerable sums on the results of the battles. With the Sylhetis indeed these birds take an even higher rank than do other fighting cocks. Wild birds are said not to be so good at fighting as those which are reared by the natives from the eggs, so for this reason the eggs are taken and hatched by the natives. The most usual manner in which this is done is for the man himself or his wife to carry them about all day fastened to his or her stomach by a cloth. The heat thus engendered seems to be ample for the purpose of incubation and I am informed that at least two out of three of the eggs which escape being smashed hatch out alright. The action of the Water Cock when fighting is rather interesting and I have been fortunate enough to witness it when the birds were fighting in their natural surroundings. Whilst hunting for water birds' eggs in a large swamp on the north bank of the Brahmaputra I was being pushed along in a small dug-out by a man in the stern and as we were anxious to get close to the birds on the nests, so that we could identify them properly, we were sneaking along as quietly as possible. On coming round the corner of some dense high reeds we came on a cock (Water Cock) just starting booming. When we saw him first he was three-quarters on to us with his head held down quite close to the water. After a second or two he raised his head and emitted a very small boom and then in rapid succession, booms each one louder than the last, the whole time his throat swelling until the feathers seemed to stand out all on end; in fact the whole exhibition reminded me much of the booming of the Bittern. Whilst thus engaged and before the Water Cock we were watching could finish his challenge, another bird started booming just inside the reeds close to him. Then for a few minutes the second bird ceased calling and suddenly there was a rush from the reeds and Water Cock number 1 was sent flying over on his side and into the water. He, however, recovered himself immediately and the two birds went at it literally tooth and nail, using their bills to hold one another by the neck whilst they seemed to claw at one another with their feet, but I could not see whether the feet were used actually for hitting or scratching or whether merely for the purpose of giving the bird a better purchase for using his beak in pulling out the other birds' feathers. Unfortunately after the birds had been fighting for a few minutes, my boatman in his excitement dropped his paddle in the water and in an instant both birds had cleared off into the jungle.

GALLINULA CHLOROPUS PARVIFRONS

The Indian Moorhen

Gallinula parvifrons Blyth, J. A. S. B., xii, p. 180 (1843) (Calcutta).

Gallinula chloropus Blanf. and Oates, Avifauna B.I., iv, p. 175; Oates in Hume's Nests and Eggs, 2nd ed., iii, p. 389; Sharpe, Catalogue, B. M., xxiii, p. 169.

Vernacular names—Jal-Murghi, *Pani-Murghi* (Hin.); *Dakabpaira* (Beng.); *Jumbu-kodi*, *Boli-kodi* (Tel.).

Description.—Head and neck black, passing into dark slaty-grey on the breast, flanks and extreme upper back; remaining upper parts rich deep mahogany brown the scapulars and feathers next the grey tinged with olive; tail almost black towards the tip; primary coverts, primaries and outer secondaries blackish, the first primary and border of wing edged white; below the deep slaty of the upper breast pales posteriorly and the centre of the abdomen is mottled with white; under tail coverts white except the central ones which are black; under wing-coverts grey tipped with white.

Colours of soft parts.—Iris red; frontal shield and base of bill bright red, the terminal third greenish-yellow; 'tibia and front of tarsus greenish-yellow, hinder part of tarsus and all toes slaty-green; an orange ring round the tibia just below the feathered portion.' (Oates).

Measurements.—Wing, 152 to 172 mm.; tail 52 to 68 mm.; tarsus, 47 to 50 mm.; culmen, ♂ 38 to 41 mm.; ♀ 32 to 35 mm.; the female is very little smaller than the male.

Young birds have the upper parts all brown, less rich and mahogany coloured than in the adult and the lower parts are rather more brown and less grey, much mixed with white.

Chick in down deep black throughout.

Distribution.—Throughout India, Burma and Ceylon; south to the Malay States and east through the Indo-Chinese countries to China and Japan.

Nidification.—Our Indian Moorhen breeds practically all through the plains and ascends the hills to a considerable height being found as high up in the Nilgiris and hills of Southern India as there is water for it to breed near, as well as in all the lakes and swamps of Kashmir up to about 8,000 ft. In the plains they commence, like most of our water birds, to breed as soon as the rains break, I should say about the middle of June, but in Kashmir they commence to lay about the last week in May. Hume seemed to think that they had two broods in the year in the hills, laying first in May and again in the latter half of July but other observers think they have only one set of eggs in the season, though as these are often destroyed and the eggs eaten by otters and other vermin, they often have a second nest under such circumstances.

The nest is just like that of the English Moorhen ; sometimes it is built in a bush or in reeds actually standing in the water and is then a fairly compact well built nest of rushes and reeds generally more or less mixed up with water weeds. At other times it is built in amongst the water weeds and is then composed principally of the weeds themselves with the upper half made of dryer rushes and leaves. It is said sometimes also to lay its eggs on a mere platform of broken-down reeds and rush leaves but I have never seen a nest of this description. Occasionally the water hen makes her nests in ditches or in amongst the weeds and cover surrounding the bigger swamps yet a little distance from the actual water itself. Twice whilst approaching swamps when about to hunt them for water birds' nests and eggs, I have almost stepped on a Moorhen's nest hidden, once in the coarse grass and once in growing rice at least 200 yards from the swamp.

The number of eggs laid varies from 5 or 6 to 12 or 14, the former being the largest number I have ever personally seen.

They are of course indistinguishable from those of our English Moorhen and they vary very little in appearance. In ground colour they range from a very pale yellowish-stone, in rare instances almost white to a deep buff stone or more rarely rich pink buff. The markings consist of small blotches of dark reddish-brown scattered thinly all over the egg and not much more numerous at the bigger end than elsewhere. In the great majority of cases the spots are rather small and dark, but now and then one comes across a clutch in which the marks are larger and bolder and of a paler yet richer tint ; equally seldom one sees a clutch in which the spots are distributed profusely over the whole surface. In 9 clutches out of 10, however, the ground is a dull grey yellowish-stone and the markings are neither large, numerous or handsome. 200 eggs average 40·6 × 29·6 mm.; maxima, *45·0* × 30·0 and 40·0 × *31·1* mm. ; minima, *36·1* × 30·4 and 39·3 × *27·0* mm. Compared with English eggs those of our Indian bird are rather smaller. Jourdain gives the average of 50 English eggs as 44·78 × 31·77 mm., whilst Witherby, probably including Jourdain's eggs gives the average of 100 as 44·44 × 31·31 mm.

In India, incubation according to the natives takes three weeks, but they also say that if the weather is very hot, the eggs will hatch a couple of days earlier whilst if there is much cold, rain and wind they will sometimes take two days longer. The hen bird sits fairly close when once the eggs are advanced in incubation but prior to that stage she generally leaves her nest long before any intruder comes close to it, sneaking off very quietly through the weeds and cover or, if the nest is in the open, she slips quietly into the water and diving, does not re-appear until she has put a good distance between herself and her home. The cock bird undoubtedly assists in incubation especially in the early mornings and evenings when the hen bird leaves her charge to go out and get a meal. The cock also probably sits a good deal at night for when traps are set by the nest for night work, it is generally a cock bird which is caught. It is probable the birds pair for life as the cock and hen remain in company throughout the winter months and long after their young have been turned adrift to work on their own.

Habits.—There is little to remark on in the Indian Moorhen in which it differs from the European bird, but I think it is on the whole more shy though occasionally when a pair take up their quarters in some small village pond, they become very familiar and will swim about apparently quite careless of the washerman lustily banging his clothes about within a few yards of them.

In Cachar, Sylhet and in Eastern Bengal where they are very common in the huge swamps which cover so much of that country, I have always found that they seem to resent being watched and seek cover very quickly. They do not fly unless closely pressed, prefering to hide but they can make their way through thick tangles of vegetation very quickly, if very quietly, and a man walking has little chance of overtaking them. When, however, they are pushed to the edge of the cover, they take to flight, either launching themselves from as high up as they can get on the reeds and bushes or else skittering along the surface of the water until they get well under way. Natives consider their flesh to be quite first class, many of them preferring them to duck or teal but to the European palate, though eatable, they certainly would not ever find their way into the pot whilst duck were obtainable. If cooked it should be remembered that they are better skinned and stewed than unskinned and roasted.

Their diet is almost omnivorous for though they feed very largely on seeds, fruit, young grass crops and water weeds they also eat equally freely almost any kind of water insect, locusts, grass-hoppers, worms and even young frogs and small fishes if the latter happen to be trapped in a small pond. In the twilight and on moonlight nights, but I think not on dark nights, they will wander some distance from the swamps into cultivation and I well remember coming home one brilliant night in June when I had been out after buffalo, putting up several of these birds out of the mustard fields as my elephant passed alongside them.

They walk well and quickly, holding themselves very erect, their small tail well up in the air and constantly flicked up and down as the bird bobs about snatching at passing insects or tearing off buds and shoots. In the breeding season both sexes have a little guttural 'chuck chuck' which they use both in calling to one another and in collecting their chicks. The call of the cock bird during the pairing season is a much louder, rather startling note sounding rather like 'Tirruck tirruck'. In addition to these they have quite a number of notes, rather soft and low, which they constantly utter when they think they are unobserved.

When swimming, the Moorhen has a curious little bobbing action much more emphasized than it is in most water birds. They swim well and at a considerable speed but though they are quite capable of diving and keeping under water for a considerable time when there is necessity, they do not seem to indulge in diving to any great extent under normal circumstances nor, as far as I know, do they ever dive for the purpose of feeding on deep water plants or the roots of the more shallow growing ones.

FULICA ATRA ATRA

The Coot

Fulica atra Linn., Sys. Nat., 10th ed., i, p. 152, (1758) (Sweden); Blanf. and Oates, Avifauna B.I., iv, p. 180; Oates in Hume's Nests and Eggs, 2nd ed., iii, p. 386; Sharpe, Catalogue B.M., xxiii, p. 210.

Vernacular names—Dasari, *Dasarni*, *Ari*, *Khurkul*, *Thekari*, (Hin.); *Barra Godar* (Purnea); *Boli-kodi* (Tel.)

Description.—Head and neck black shading into slaty-black on the upper plumage the whole having a steel blue sheen; below the black of the throat shades into the slaty-grey of the under parts, palest on the centre of the breast and abdomen, darkest on the vent and under tail coverts; primaries and outer secondaries grey, the first primary white on the outer web and the edge of the wing also white; outermost secondaries paler grey and mottled with white at the tips, then disappearing in very old birds.

Colours of soft parts.—Iris red, red-brown or blood red; bill and shield white, the former tinged with fleshy pink, especially at the base; legs and feet dull greenish, tibia orange.

Measurements.—Wing, 185 to 220 mm.; tail, 54 to 63 mm.; tarsus, 56 to 64 mm.; culmen 33 to 38 mm. The measurements of the male and female differ very little. Witherby gives the measurements of 12 British birds as, ' Wing, 200 to 225; bill from shield 33 to 38 mm.'

Young birds are brown above and have the lower plumage paler and much more mottled with white.

Nestlings in down, black rather a greyish-black beneath; the down with hair like tips, white over the body, yellowish on the wings, orange on the neck and throat and crimson scarlet on the forecrown and round the eyes.

Nestlings in later stage drop all the hair like tips except the crimson ones.

Distribution.—Practically the whole of Europe and Asia. In India it is found and is resident in every part of the country when there are large lakes and swamps, but in those parts in which the water dries up after the rains cease they are only seasonal visitors. It has not yet been obtained in Ceylon.

Nidification.—Wherever there is sufficient water there the Coot will be found breeding, nor is it necessary that the swamps and lakes should be of any very great size for occasionally the Coot will make its nest in or near quite small ponds and occasionally even by extremely dirty roadside ditches. Naturally it prefers the larger swamps and Jheels where the water is cleaner and food more plentiful.

The nest differs from many of those of the other birds we have discussed in this article in being as a rule very much better built, and in some instances very much larger. Hume measured one that was no less than 3 feet in diameter at the bottom, about 2 feet high and nearly a foot across at the top, which contained a depression about 8 inches across and 3 inches deep. A nest like this however, is exceptional both in size and construction even when placed in amongst reeds at the edge of the water. As a rule the nests though deep, are smaller at the bottom than at the top and are composed principally of rushes which are wound round several of the supporting reeds. In the base of the nest a good proportion of water weed is used and this part of the nest may be actually in the water or raised a few inches above it. The site selected varies a good deal. I have seen nests placed in the very densest of reed thickets and again in a place where the reeds were so thin that you could easily see the nest from a few feet off. Sometimes, though I think this is exceptional, the nest is actually built in the open on floating water weeds but this is less common with our Indian bird than it is with the European. In India our birds lay anything from 5 to 10 eggs but it is unusual to find more than 7 or 8 and I have known 3 eggs, possibly a second laying, well incubated. They breed both in the plains and in the Himalayas up to at least 8,000 feet, possibly considerably higher. In the latter the breeding season is May and June but in the plains they very seldom begin to lay until July and eggs may be found all through that month, August and September.

In colour the eggs vary very little, the ground-colour ranges from a pale yellowish or brownish-grey to a fairly warm buff or pale café-au-lait. Over this is scattered tiny spots and freckles of blackish brown with a few rather larger underlying markings of neutral tint. A few eggs have the markings a little larger and more of a red-brown in character but even in these the markings are never very conspicuous or very large. One hundred Indian eggs average 53·1 × 35·6 mm.; maxima, *57·0* × 37·1 and 50·3 × *37·8* mm.; minima, *47·5* × 35·0 and 50·3 × *34·3* mm.

The eggs are said to take 21 days to incubate, occasionally only 20. Both birds take their share of incubation and both parents go about with the young when they are hatched and probably they mate for life.

Habits.—The Coot is a bird which undoubtedly prefers the great stretches of water which in addition to ample cover round the shores, etc., have wide open spaces where they can swim about during the daytime. On such pieces of water they often collect in very great numbers and this especially in North-west Sind and Punjab. In Sind on the Munchar and other lakes they are said often to gather in flocks numbering hundreds of thousands. Here they form an object of sport for some of the Mahommedan classes who employ many ways of catching or killing them for the purpose of food. One way is for the sportsman to wade into the water until it comes about up to his shoulders or neck. He then covers his head with the skin of an egret and walking quietly along is easily able to get close enough to his game to shoot them with the bow and arrow and owing to the noiselessness of this weapon even the struggle of the bird when not killed outright seldom seems to warn its comrades of their danger. Sometimes the Coots are driven over the heads of men who lie in wait for them with bows and arrows, generally standing in the water sufficiently deep merely to allow them free use of their arms. As the Coots are driven overhead the bowman shoots and very frequently hits his object. Once on the wing Coots are no mean fliers so that it speaks highly for the skill of the bowman if he can kill enough birds in this way to make it pay. In getting off the water the Coot is very little faster than either the Moorhen or the Purple Moorhen, skittering along the surface just as they do before rising into the air and then for some distance flying with his legs hanging down and looking very ungainly. Coots are very gregarious and apparently get on very well amongst themselves, but they are notorious for their bullying propensities towards duck and teal who breed on the same lakes with them and where Coots become too numerous, duck seldom breed. In India of course we have but few duck who breed near lakes. Comb Duck, Whistling Teal and Cotton Teal all breed for the most part in holes of trees or banks and suffer little from the persecution of the Coots, but the Spot-billed Ducks who make their nests either in amongst the reeds or in the cover close to the lake are often very much worried by Coots, and I have seen a pair of these birds constantly following and attacking a wretched Spot-bill who had hatched her chicks and brought them on to the lake although at that time, April, the Coots were not even thinking of breeding.

I cannot say that I have ever seen them attacking young ducklings with the idea of eating them though they are said to do this sometimes in England. For the main part their diet is vegetarian and consists of the shoots of the various plants that grow round water as well as the leaves and roots of those that grow in it. To obtain the latter they dive and are extremely active in so doing and can stay under water for a considerable time, often as long as 60 seconds. They also eat almost any kind of insect, worm, small fish, frogs, etc. and also devour the eggs of other birds should they come across them. As an article of diet himself the Coot varies greatly. When he has been feeding on grain and shoots of rice and other plants his flesh is almost as good as that of some of the ducks but when he has been indulging his appetite for fish to the exclusion of vegetable diet his flavour is unpleasantly rank and coarse.

He has a considerable repertoire of notes most of them rather soft chuckling sounds and not unpleasant but his breeding season call is a loud and rather harsh 'Kraw Kraw'. The chicks utter a rather shrill piping cry in reply to which the parent birds have a little soft chuckle generally so low that to the human ear it is inaudible 20 yards away although the young birds seem to hear it to a much greater distance.

REVISION OF THE FLORA OF THE BOMBAY PRESIDENCY

BY

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PART I

Cooke's 'Flora of the Bombay Presidency' was completed in 1908. Since then a number of monographs of various orders and genera have appeared. In addition, botanical literature has been enriched by several new Floras which reveal a more critical treatment of the subject than we find in many of the older publications. I mention only Gamble's 'Flora of Madras,' Parker's 'Forest Flora of the Punjab,' and Haines's 'Botany of Bihar and Orissa.'

I propose to revise the 'Flora of Bombay' by incorporating in a series of articles all the changes that the study of systematic botany during the last fifteen years has made necessary. The articles will contain corrections, more complete descriptions where such are wanted, changes of names wherever the laws of nomenclature, or historical considerations, or the more detailed study of a species or groups of species require it, descriptions of new species or of species new to the Presidency, a careful examination of the synonymy of species, and, finally, the distribution of species within our area as well as outside it where recent investigations have widened or reduced the geographical area of a species.

Wherever possible I shall refer to Cooke's 'Flora.' If this is done without any further remarks I wish to imply that I agree with his names, descriptions, or synonymy.

As to the delimitation of the families I have decided to follow 'The Families of Flowering Plants' by J. Hutchinson.

In order to avoid lengthy titles of constantly recurring references I shall use the following abbreviations :—

Cke.	...	Cooke, 'Flora of the Bombay Presidency.'
F.B.I.	...	J. D. Hooker, 'Flora of British India.'
Gamble	...	J. S. Gamble, 'Flora of the Presidency of Madras.'
Haines	...	H. H. Haines, 'The Botany of Bihar and Orissa.'
Parker	...	R. N. Parker, 'A Forest Flora for the Punjab with Hazara and Delhi.'
Talbot	...	'Forest Flora of the Bombay Presidency and Sind.'
W. Ic.	...	R. Wight, 'Icones Plantarum Indiæ Orientalis.'

It has been my endeavour to put in references to iconographic works wherever possible.

Cooke, in his synonymies, refers to a number of authors whom I shall not consider unless the correctness of their identifications can or have been verified by specimens, viz. J. Graham, 'A Catalogue of the Plants grown in Bombay and its Vicinity,' Dalzell and Gibson, 'Bombay Flora,' Woodrow, 'Flora of Bombay,' in the *Journal of the Bombay Natural History Society*, Watt, 'Dictionary of Economic Products,' Talbot, 'A Systematic List of the Trees and Shrubs of the Bombay Presidency.'

The revision will not follow any systematic order. Of some orders or genera a considerable amount of material has accumulated, whilst for others further investigations are required or are in progress. Besides I am not equally well acquainted with all the orders and genera. It is, therefore, natural that the results should be published in the order in which they have matured in the course of many years, based either on the work of others or on my own observations.

My chief intention in publishing these revisions is to draw the attention of local botanists to the progress made in the knowledge of our flora and to furnish materials towards a future publication of 'A Flora of the Bombay Presidency.' I shall be grateful for any corrections or additions.

I take this opportunity of expressing my indebtedness to all those who have helped me in many ways in the study of the Bombay flora. Mr. L. J. Sedgwick, I.C.S., who collected in various parts of the Presidency and who was a keen systematist, died in 1925. Mr. T. R. Bell, I.F.S., late Chief Conservator of Forests, put his rich herbarium at my disposal. Mr. C. McCann, Assistant Curator of the Bombay Natural History Society, has made many valuable observations and has helped me chiefly in working out the difficult family *Gramineæ*. He has recorded over fifty species of grasses new to the Presidency. Mr. T. S. Sabnis, now Economic Botanist to the Government of the United Provinces, worked, as Professor of Botany, for a number of years in the Herbarium of St, Xavier's College. Prof. J. F. D'Almeida of the same College, though better known by his researches on Indian Ferns, has added considerably to our knowledge of the distribution of the Phanerogams. Prof. F. Hallberg has, during the short period of ten years, done more for the exploration of the Bombay Flora than any other worker in this field. Unfortunately a premature death carried him away in 1924 before he was able to publish his results.

I must not forget to tender my sincere thanks to the Curators of the Herbaria of the Agricultural College, Poona, of the Royal Botanic Gardens, Calcutta, of the Forest School of Dehra Dun, of the Agricultural Institute of Coimbatore, and of the Bombay Natural History Society.

MENISPERMACEÆ (Cke. I, 17)

Genera 59 ; species about 340, distributed over the Tropics of both hemispheres ; a few are temperate

Keys to Genera.—[1]

[1] In many cases it will be found useful to have two or even more keys, according to the number of characters considered in each key. Wherever I find a really good key I shall not hesitate to borrow the whole or part of it.

First key (after Cke.)—

I. Ovaries 3 or more—
 1. Seed oblong or globose.
  (*a*) Style-scar sub-terminal ; filaments free ... 1. *Tinospora*, Miers.
  (*b*) Style-scar sub-basal ; filaments connate ... 2. *Anamirta*, Colebr.
 2. Seed horse shoe-shaped.
  (*a*) Petals 6, minute, cuneate ... ... 3. *Tiliacora*, Colebr.
  (*b*) Petals 6 auricled ... ...
   * Condyle septiform ... ... 4. *Diploclisia*, Miers.
   ** Condyle globose or pyriform ... ... 5. *Cocculus*, DC.
II. Ovary solitary—
 1. Sepals free.
  (*a*) Petals of male and female 3-5, free ... 6. *Stephania*, Lour.
  (*b*) Petals of male 4, connate, of female 1 ... 7. *Cissampelos*, Linn.
 2. Sepals connate ... ... 8. *Cyclea*, Arn.

Second key, to male specimens (after Gamble).—

I. Stamens connate, anthers in a terminal head or ring—
 1. Flowers in stalked solitary or unbellate heads ; anthers on the rim of a stalked disk ... 6. *Stephania*, Lour.
 2. Flowers in panicles
  (*a*) Anthers in a globular head, petals 0 .. 2. *Anamirta*, Colebr.
  (*b*) Anthers in a ring, petals connate
   * Calyx campanulate ... ... 8. *Cyclea*, Arn.
   * * Calyx of 4 spreading sepals ... ... 7. *Cissampelos*, Linn.
II. Stamens free—
 1. Leaves deeply cordate ... ... 1. *Tinospora*, Miers.
 2. Leaves acute, obtuse, or sub-cordate at base
  (*a*) Flowers 2·5 mm. long, anthers oblong, opening down the sides ... ... 3. *Tiliacora*, Colebr.
  (*b*) Flowers 1 mm. long, anthers globose, opening across the top.
   * Panicles up to 30 cm. long, drooping ... 4. *Diploclisia*, Miers
   * * Flowers in small fascicles or cymes ... 5. *Cocculus*, DC.

Third key, to female specimens (after Gamble) :—
I. Style-scar terminal ... ... 1. *Tinospora*, Miers.
II. Style-scar basal
  1. Flowers in a raceme of small cymes subtended by foliaceous cordate bracts ; drupe hirsute. 7. *Cissampelos*, Linn.
  2. Flowers in compound umbels or panicles
    (*a*) Ovary solitary.
      * Flowers in panicles ... ... 8. *Cyclea*, Arn.
      * * Flowers in umbellate heads or in solitary condensed cymes ... ... 6. *Stephania*, Lour.
    (*b*) Ovaries 3—many
      * Drupes pedicelled on the receptacle.
        @ Leaf-blade rotund-cordate, acuminate, less than twice the petiole ; petals 0 ... 2. *Anamirta*, Colebr.
        @ @ Leaf-blade oblong-ovate, acute, seldom cordate, more than 4 times the petiole, petals 6, minute ... ... 3. *Tiliacora*, Coleb.
      * * Drupes sessile on the receptacle
        @ Drupes elongate, 25 mm. long, panicles long, drooping ... ... 4. *Diploclisia*, Miers.
        @ @ Drupes pisiform, under 8 mm. ... 5. *Cocculus*, DC.

1. TINOSPORA MIERS (Cke. I, 18).

Species 25, occurring in most palæotropical regions, but most abundantly in Indo-Malesia.

1. Leaves tomentose, often 3-lobed ... ... 1. *T. malabarica.*
2. Leaves glabrous, not lobed ... ... 2. *T. cordifolia.*

1. **Tinospora malabarica,** Miers in Ann. Hist. Nat., 2. Ser. vii (1851), 38, in Contrib. iii (1871), 33 ; F.B.I. i. (1872), 96 ; Cke. i (1903), 18 ; Haines 18. *Menispermum malabaricum*, Lam. Encycl., iv (1797), 96.—*Cocculus malabaricus* DC. Prodr. i (1824), 97 ; Wall. Cat. (1828) 4969.—*Pee-amerdu*, Rheede Hort. Malab. vii (1688) t. 19.—*Tinospora tomentosa* Miers in Ann. Hist. Nat., 3. ser. xiii (1864), 319, in Contr. Bot. iii (1871), 33 ; F.B.I. I (1872), 96.—*Cocculus tomentosus*, Coleb. in Transact. Linn. Soc. xiii (1822), 59 ; Wall. Cat. (1828), 4956.—*Menispermum tomentosum*, Roxb. Fl. Ind. i (1832), 813.

I have followed Diels in Engler's Pflanzenr., iv, 94 (1910), 142, in uniting *Tinospora tomentosa*, Miers with *T. malabarica*. The description, therefore, has to be slightly modified.

Description : A large climber ; stems about 2 cm. in diameter ; old branches smooth and shining, with light-coloured papery bark more or less warty ; young parts clothed with whitish hairs. Leaves membranous or papyraceous, sparingly pubescent above, pilose below, sometimes whitish tomentose, broadly ovate-cordate or rotundate-cordate, sometimes obsoletely angular, acuminate, 7·5–23 cm. long and broad, 5–7-nerved ; petioles 6–12 cm. long, striate.

Pseudo-racemes often arising from the old branches, pedunculate, simple, up to 15 cm. long. Male flowers : Pedicels fasciculate, about 3–5 mm. long ; sepals 6, yellowish-green, the outer ones minute, thin, 1–1·4 mm. long, the inner membranous, 3–5 mm. long, 2–5 mm. broad ; petals membranous, clawed at base, obliquely rhomboid-ovate, acute, above the claw with the margin slightly inflexed, about 2 mm. long, 1–3 mm. broad ; stamens 3 mm. long, filaments slightly dilated towards apex. Female flowers not seen.

Drupes 1–3, scarlet or orange, smooth, on thick stalks ; endocarp with many sharp-pointed tubercles.

Locality : Konkan : (Dalzell and Gibson). *Kanara :* Arbail Ghat, 600 m. (Sedgwick 5125 !) ; Yellapur, evergreen forests (T. R. Bell, 7521 !).

Distribution : Bengal, Khasia, 300–1200 m., Assam, Orissa, W. Peninsula, Madras Pres., in almost all districts, Ceylon.

Fruit : January.

2. **Tinospora cordifolia,** Miers in Ann. Hist. Nat., 2. Ser. vii (1851), 38, in Ann. Hist. Nat., 3. Ser. xiii (1864), 317 ; F.B.I. i. (1872), 97 ; Cke. I, 18 ; Diels in Engler's Pflanzenr. iv, 94 (1910), 139 ; Haines 18.—*Menispermum malabaricum*, var. β Lam. Dict., (1797), 96.—*Cocculus cordifolius* DC. Syst. i (1818), 518,

Prodr. i (1824), 97 ; W. Ic.t. 385, 486 (1840).—*Menispermum cordifolium* Willd. Spec. Pl. iv (1805), 826 ; Roxb. Fl. Ind. iii (1832), 811.—*Cocculus verrucosus*, Wall. Cat. 4966 (1828).—*Cit-amerdu*, Rheede, Hort. Malab. vii (1688), t. 21.

Description : A large glabrous climber with succulent, corky, groved stems ; branches sending down slender pendulous fleshy roots,* terete, striate, with tubercled, pale, sometimes shining or glaucous bark. Leaves membranous, 7–9-nerved, 5–10 cm. or rarely 12 by 10 cm., roundish or subdeltoid, cordate with a broad sinus and large basal lobes, obtuse or more or less cuspidate, reticulately veined with microscopic glistening glands beneath (Haines) ; petiole 2·5–7 cm. long.

Racemes rather lax, 5 cm. long, elongating and finally often longer than the leaves, axillary, terminal or from the old wood. Male flowers clustered in the axils of small subulate bracts. Sepals : the 3 outer very small, ovate-oblong, acute, the 3 inner larger, membranous, broadly elliptical, concave, 3–4 mm., yellow. Petals 6, equal, about 2 mm. long, broadly spathulate, each loosely embracing a stamen when young, claw cuneate, lamina triquetrous or subtrilobed, reflexed at apex. Pistillode 0. Female flowers usually solitary, similar to male, but sepals green, margins not reflexed, staminodes short linear.

Carpels 1–3, widely separated on the short fleshy gynophore, dorsally convex, ventrally flat or nearly so, scarlet, size of a large pea ; style-scar subterminal. Stone broadly ellipsoid, with a slender dorsal ridge and a ventral depression, slightly muricate.

Locality : *Konkan* : Bhandup in Salsette (Blatter and McCann, 28892 !).—*Deccan* : Poona, (Woodrow !).—*S. M. Country* : Belgaum (Ritchie) ; Badami (Cooke !) ;—Dharwar 700 m. (Sedgwick, 2867 !) ; Mishrikot in Dharwar Dist. (Sedgwick 2192 !).

Distribution : Throughout tropical India, Burma, Andamans, Ceylon.

Flowers : January and August, 1917 (in Dharwar), January 1919 (in Salsette).

Uses : Several species of Tinospora (*T. malabarica*, *T. crispa*, *T. cordifolia*) are well known in Indo-Malayan countries as a tonic in fevers. The roots, stems and leaves of *T. cordifolia* yield a watery extract which, from ancient times, was held in high esteem in Hindu medicine (*Gulancha*).

2. ANAMIRTA Colebr. (Cke. I, 19).

One species, in tropical Asia, from British India to New Guinea.

The name *Anamirta paniculata*, Colebr. must be changed into *A. cocculus* Wight and Arn. as is evident from the following synonymy :

1. **Anamirta cocculus**, Wight and Arn. Prodr. 1 (1834), 446 ; F. B. I. i. (1872), 98 ; Haines 17 ; Gamble 27.—*A. paniculata*, Colebr. Trans. Linn. Soc. xiii (1819), 52, 66 ; Cke. I, 19.—*A. toxifera*, Miers in Ann. Nat. Hist., 3. Ser. xiv (1864), 51.—*Cocculus suberosus*, DC. Syst. I (1818), 519, Prodr. i (1824), 97.—*Menispermum Cocculus*, L. Spec. ed. 1 (1753), 340 : Gaertn. Fruct. i (1788) 21, tab. 70, f. 7 ; Roxb. Fl. Ind. iii (1832), 807.—*M. heteroclitum* Roxb. Fl. Ind. iii (1832), 817.—*M. monadelphum*, Roxb. Cat. Merc. Angl. Ind. or. t. 130.—*Cissampelos Cocculus*, Poir. in Lam. Encycl. v (1804), 9, *partim*.—*Tuba flava* Rumph. Amb. v (1685), 38, tab. 24.—*Natsjatam* Rheede, Hort. Malab. vii (1688), tab. 1.

Description : Cke. I, 19.

Locality : *Konkan* (Law).—*N. Kanara* : (Talbot 3514).

Distribution : Khasia Hills, Assam, Eastern Bengal, from Orissa and the Konkan to Ceylon, Malayan Islands to New Guinea.

Uses : The berries constitute the '*Cocculus indicus*' of Pharmacy, also called '*Coque du Levant*'. In India and Malaya they are used for poisoning fish and birds that do damage ; it is stated that to eat animals killed in this way is sometimes dangerous.

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* For the anatomy of these roots see 'C. Tadulingam and S. N. Chandrasekharan,' Anatomy of the Aerial root in *Tinospora cordifolia*, Miers. Proc. 11th Ind. Sc. Congress, p. 149.

The Hindus mix the poison with ointments and use it medicinally.

The poison is contained in the albumen. It is the source of picrotoxin which, in spite of many investigations, is very incompletely known. It also contains fifty per cent of oil consisting of elain and stearin, which is employed for industrial purposes. In the mesocarp there is a tasteless substance, the menispermin (C_{36} H_{24} NO_4after Steiner) which causes vomiting. It is used for adulterating beer. Root and stem are useful against fever and can also be employed for dyeing yellow.

3. TILIACORA Colebr. (Cke. I, 20).

Species 15.—Warm regions of Continental Asia and Africa.

Diels has changed the name of *Tiliacora racemosa*, Colebr. into *T. acuminata*, Hook. f. and Thoms. Dunn (in Kew Bull., 1916, p. 59) points out that Diels is correct, under the Vienna rules of Nomenclature, in restoring this specific name; but he is wrong in attributing the combination to Hook. f. and Thoms. because it was used by Miers before.

1. **Tiliacora acuminata,** Miers in Ann. Hist Nat. Ser. 2, vii (1851), 39; Hook. f. and Thoms. Fl. Ind. i (1855), 187; Scheffer in Nat. Tijdsch. Ned. Ind. xxxii (1873), 396, tab. vii; Gamble 28; Haines 19.—*T. racemosa*, Colebr. in Transact. Linn. Soc. viii (1822), 67; Miers, Contr. iii (1871), 76, t. 104; F. B I. i (1872), 99; Cke. 1, 20.—*Cocculus acuminatus* DC. Syst. i (1818), 527.—*Cocculus variegatus*, Wall. Cat. n. 394 (1828).—*Cocculus polycarpus*, Wall. Cat. n. 4958, excl. K. and L. (1828).—*Menispermum acuminatum*, Lam. Encycl. iv (1797), 101.—*Menispermum polycarpon*, Roxb. Fl. Ind. iii (1832), 816.

Locality : Cooke has not observed the plant in the Presidency; Graham and Hook. f. and Thomson say it occurs in the Konkan. I have seen one specimen growing in Poona (Hallberg, 18069 !), but it may have been cultivated.

Distribution : Bengal to Orissa and the Konkan through S. India to Ceylon, Burma, Singapore, Cochin China.

Flowers : June

4. DIPLOCLISIA, Miers.

Scandent shrubs; branches pendulous. Inflorescence compound, often elongate. Male flowers: Sepals 6, the inner broader. Petals 6, cuneate-ovate, auricled at the base. Stamens 6; filaments thickened upwards; anthers subglobose, 4-lobed; rudimentary carpels minute. Female flowers: Sepals and petals as in the male flowers. Staminodes 6, filamentous, provided at the apex with the rudiments of greatly reduced anthers. Carpels 3; ovary gibbous-semiglobose; style short, stout.

Drupes 3 or 1 by abortion, curved in outline, oblong-obovoid, compressed; style-scar conspicuous, basal; exocarp thin-fleshy; endocarp transversely ridged and centre reduced to a thin flat septum. Seeds hippocrepiform; albumen scanty; embryo hippocrepiform; cotyledons broadly linear, foliaceous, slightly fleshy, incumbent, much longer than the very short radicle.

Species 3. Indo-Malayan countries, Central China.

Cocculus macrocarpus, Wight and Arn. (Cke. I, 20) has been restored to the genus *Diploclisia* by Diels.

1. **Diploclisia glaucescens.** Diels in Engler's Pflanzenr. iv, 94 (1910), 225, t. 77; Gamble 28.—*D macrocarpa*, Miers in Ann. Hist. Nat .2. Ser. vii (1851), 42 *ampl.*; Beccari, Malesia i (1877), 152; Gagnep. in Fl. gen. Indochine i (1908), 140, *partim.*—*Cocculus glaucescens*, Blume Bijdr. (1825) 25.—*Cocculus macrocarpus*, Wight, Ill. 1 (1840), 22, tab. 7; Wight and Arn. Prodr. Fl. Ind. i (1834), 13; F.B.I. i (1872), 101; Cke. 1, 20.—*Diploclisia inclyta* Miers in Ann. Hist. Nat. 3. Ser. xix (1867), 87 n.n.—*D. lepida*, Miers in Ann. Hist. Nat. 3. Ser. xix (1867), 87 n.n., in Contr. Bot. iii (1871), 284.—*D. pectinervis*, Miers in Ann. Hist. Nat. 3. Ser. xix (1867), 87 n.n., in Contr. Bot. iii (1871), 284.—*Quinio cocculoides*, Schlechtd. in Linnæa, xxvi (1854), 732.—*Cebatha macrocarpa* O. Ktze, Rev. gen. i (1891) L, 9.

Description : Cke. I, 20.—Fr. reddish (Gamble), pale-orange (Diels).

Locality : Konkan : Juvem in Salsette (Blatter and Mc. Cann, 18046 !); Kenery Caves in Salsette (Blatter and McCann, 18690 !); Bhorgiri near Bhimashankar (V. K. Vaidya, 18065 !); Matheran (Woodrow ! Mary Ferreira, 17467 !

17465 ! F. D'Almeida, 17470 ! 17469 ! 17451 !).—*Deccan* : Khandalla in ravine below Kuna (Blatter and McCann, 17473 ! ; Khandalla (Blatter and McCann, 17460 ! 18056 ! 18048 ! Loele 18045 !) ; Bhor Ghat, (Meebold, 4489) ; Panchgani, (May Langham, E. 17 !) ; Mahableshwar (Birdwood).—*N. Kanara* : Without locality (T. R. Bell, 5964 !) ; Karwar (T. R. Bell, 4051 !).—*S. M. Country* : Belgaum (Ritchie).

Distribution : From the Konkan southwards, forests of the W. Ghats in Malabar, Nilgiris, Pulneys, Travancore up to 1,800 m. Ceylon, Assam, Chittagong to New Guinea, South China.

Flowers : March 1917, 1918 (Khandalla) ; March 1918 (Matheran) ; April 1918 (Matheran, North Kanara); June 1918 (North Kanara).

Fruit : April 1917 (Khandalla) ; May 1893 (North Kanara) ; May 1918 (Bhimashankar) ; July 1917 (Khandalla).

5. COCCULUS DC. (Cke. I, 20).

Species 11.—All warm countries.*

* Species of *Cocculus* have been found in the earliest Upper Cretaceous sediments of the Missisippi. See Berry, E. W. Upper Cretaceous Floras of the Eastern Gulf Region of Tennessee, Missisippi, Alabama and Georgia. U. S. Geol. Surv. Prof. Paper, 112 (1919).

Cocculus villosus, DC. must be called *Cocculus hirsutus*, Diels.

1. **Cocculus hirsutus**, Diels, in Engler's Pflanzenr. iv. 94 (1910), 236 ; Gamble 29 ; Haines 19.—*C. villosus*, DC. Syst. i (1818), 525 ; F.B.I. i (1872), 101 ; Cke. i, 21.—*C. sepium*, Coleb., in Transact. Linn Soc. xiii (1822), 58, tab. 6, fig. 2.—*C. hastatus* DC. Prodr. i (1824), 98. *C. Aristolochiæ* DC. Syst. Veg. i (1818) 520.—*Menispermum hirsutum*, Linn. Sp. ed. 1 (1753) 341 ; Roxb. Fl. Ind. iii (1832), 814.—*M. myosotoides*, Linn. Sp. ed. i (1753), 341.—*M. villosum*, Lam. Dict. iv (1797), 97, *non* Roxb.—*Holopeira villosa*, Miers, in Ann. Hist. Nat. 3. Ser. xix (1867), 28 n.n., in Contr. Bot. iii (1871), 271, pl. 126.—*Cebatha hirsuta*, O. Ktze. Rev. gen. i (1891), 9.

Description : Cke. i, 21.—Leaves often coarsely toothed or with triangular obtuse or acute lobes. Size of leaves : up to 10 cm. long.—Sedgwick's No. 2241 is a common prostrate form in fields. It is very different from the hedge plant.

Locality : Kathiawar : Porbandar (Cooke !).—*Khandesh* : Chanseli Hill (Blatter and Hallberg, 27348 !) ; Dangri, bank of Bori River (Blatter and Hallberg, 18047 !) ; Bor, banks of Bori River (Blatter and Hallberg, 18050 !) ; Amalner, banks of river (Blatter and McCann, 18051 !) ; Umalla, banks of Tapti (Blatter and Hallberg, 18075 !) ; Bhusaval, banks of Tapti (Blatter and McCann, 18049 !).—*Konkan* : Bandra, seashore (Sedgwick, 7332 !) ; Ghatkopar, Salsette (Blatter and McCann, 28946 !) ; Thana Distr. (Bell, 3813 !) ; Parsik Hill, Thana Distr. (Blatter and McCann, 28916 !) ; Trombay (Blatter and Hallberg !) ; Karanja Island (Hallberg !) ; Revdanda (M. Ezechiel, 17448 !).—*Deccan* : Bairawadi, near Purandhar (Blatter and McCann, 17471 !) ; Poona (Herb. St. X.C., 18068 !) ; Panchgani (Blatter !).—*S. M. Country* : Dharwar Distr. (Sedgwick, 1922 ! 2308 ! 2241 !) ; Kappatgudd Hills, Dharwar Distr. (Sedgwick, 5235 ! 5227 !) ; Hubli (Sedgwick, 5171 !) ; Hulpur (Sedgwick, 5326 !).—*Kanara* : (Stocks ex Diels).

Distribution : Tropical and subtropical India, from the foot of the Himalaya to Malabar, Ceylon, Pegu, South China, Arabia, tropical Africa.

Flowers : January 1919 (Dharwar, Hubli) ; February 1918 (Thana) ; March 1920 (Bandra) ; November 1918 (Salsette) ; December 1916 (Dharwar) ; December 1918 (Khandesh, Thana Distr.).

Fruit : February 1917 (Revdanta) ; February 1919 (Dharwar) ; March 1919 (Dharwar).

Vern. Name : Vasant (in Khandesh).

2. **Cocculus pendulus**, Diels. in Engler's Pflanzenr. iv, 94 (1910), 237 ; Gamble 29.—*C. Leæba* DC. Syst. i (1818), 529 ; F. B. I. i (1872), 102 ; Cke. I, 20.—*C. Cebatha* DC. Syst. i (1818), 527, Prodr. i (1824), 99.—*C. lævis*, Wall. Cat. 4975 (1828).—*C. glabra* Wight and Arn. Prodr. i (1834). 13.—*C. Leæba* Forsk. Fl. ægypt.—arab. (1775), 172 —*Cebatha edulis*, Forsk. Fl. ægypt.—arab. (1775) 171.—*Cebatha edulis*, Forsk. ex Vahl, Symb. Bot. i (1790), 80.—*Cebatha pendula* O. Ktze., Rev. gen. i (1891), 9.—*Epibaterium pendulum*, Forst. Gen. (1776) 108, tab. 54.—*M. leæba*, Del. in Descript. Egypt. t. 51, fig. 2, 3. (1813).

Description as in Cke. I, 21.

Locality : *Sind* : near Karachi (Cooke ! Woodrow !) ; Tatta, amongst tombs (Blatter and McCann, D 549 ! D 548 ! D 598 !).—*Kathiawar* : Porbandar (Cooke !) ; Dwarka (Herb. St. X. C. 18067 !).—*Deccan* : Sajalpur-Ghanegaon, Ahmednagar Distr. (Sedgwick, 7380 !),

Distribution : Punjab Plain to N. Circars, Deccan and Carnatic to Tinnevelly, Afghanistan, Baluchistan, Arabia, tropical and subtropical Africa.

Note :—This is a very variable plant as regards texture, size and nervation of leaves and length of petiole. There are also many variations with regard to the shape and hairiness of the leaves.

But as there are endless transition forms it is impossible to describe good varieties.

Fruit : February 1920 (Ahmednagar Distr.)

6. STEPHANIA, Lour. (Cke. I, 22).

Of this genus 32 species are known. As to the Indian species there exists a good deal of confusion. Hook. f. and Thoms. in F. B. I. i, 103 describe 3 species : *S. hernandifolia* Walp., *S. elegans*, Hook. f. and Thoms., and *S. rotunda*, Lour. Cooke in Fl Bomb. i, 22 adopts the first name for the Bombay plant, without giving any synonyms. In 1910 Diels monographed the *Menispermaceæ* (Engler's Pflanzenr. iv, 94). He mentions 7 species as occurring in British India :

1. *S. andamanica*, Diels.
2. *S. glandulifera*, Miers. Syn. : *S. rotunda*, Hook. f. and Thoms., *partim*, *non* Lour.
3. *S. glabra*, Miers. Syn. : *S. rotunda*, Hook. f. and Thoms., *partim*, *non* Lour.—*Clypea Wightii*, Arn.
4. *S. elegans*, Hook. f. and Thoms.
5. *S. gracilenta*, Miers.
6. *S. japonica* Miers.
7. *S. hernandifolia*, Walp.

To these Gamble (Fl. Madras 30) has added another species :

8. *S. Wightii*, Dunn.—Syn. : *S. rotunda*, Hook. f. and Thoms. (should be *partim*), *non* Lour.—*Clypea Wightii*, Arn. in Wight Ill. i, 22.

Nos. 1, 4 and 5 of the above list do not concern us for the present as they are not represented in our area. Nos. 2 and 3 (*S. glandulifera* and *glabra*) have been separated from *S. rotunda* of the F.B.I., i, 103 by Diels, and that for good reasons. As to *S. glabra*, Dunn in Kew Bull. 1916, 59, does not agree with Diels' conclusions. He says : ' Diels places *Clypea Wightii*, Arn. under *S. glabra*, Miers, a species described by him (Diels) as having "*flores filiformi-pedicellati.*" In Wight's own specimen (No. 2462) in the Kew herbarium there is a detached male inflorescence, however, which is a peduncled head, and similar ones are in their natural position in the Calcutta specimen (Kew Dist. 45). Wight himself describes the male flowers as being all "collected into a single capitulum." (Ill. i, 22). Arnott's species cannot therefore, I think, be so placed, but must be provided with a distinguishing name in the genus.' He has given it the name *S. Wightii*, Dunn in Gamble, Fl. Presid. Madras 30.

After the separation of these three species there is nothing left of the *S. rotunda* of the F.B.I., especially as *S. rotunda*, Lour. is only known from Cochin-china, and as so far no specimens have been discovered that agree completely with Loureiro's type specimen.

We come to Nos. 6 and 7 (*S. japonica* and *hernandifolia*). The chief difference between the two species is this : *S. japonica* has glabrous inflorescence and leaves, whilst *S. hernandifolia* has papillose-puberulous inflorescence and leaves usually pubescent below. The question might be discussed whether the two species should not be united, especially in the face of remarks like this made by Diels himself when speaking of *S. hernandifolia* (p. 281). '*Species foliorum ambitu et pubescentia atque druparum structura haud invariabilis observatur. Formæ nonnullæ ex Australia allatæ indumento subtomentoso excellunt*; *tamen intermediæ transitoriæque in eisdem regionibus tam numerosæ sunt, ut illæ a reliquis separari non possint.*' Also in his description of *S. hernandifolia* he mentions : '*Lamina supra glabra, suptus, præcipue ad nervos floccoso-puberula interdum subtomentella raro glabrata.*' Still, considering that Diels had a great amount of material at his disposal, we must suppose that he had sufficient reasons for keeping the two species separate. The descriptions of *S. hernandifolia* by Hooker f. and Thomson and Cooke were evidently prepared from mixed material of both species.

I propose, therefore, to give in this place both species with their descriptions and complete synonymy in order to avoid confusion. We must leave it to the Bombay botanists to ascertain the distribution of the two species and, at the same time, to determine their systematic value. As some changes have to be made in the general characters of the genus I shall first give a full description of *Stephania*, Lour. as conceived by Diels.

STEPHANIA, LOUR.

Scandent shrubs, rarely herbs. Leaves peltate. Inflorescence mostly pseudo-umbellate, simple or compound, rarely paniculate. Male flowers: Sepals 6–8, mostly subequal, concave, obovate, rarely unequal. Petals 3–4, dilate-obovate or suborbicular, rarely 0. Stamens 6; anthers on the rim of the flattened top of the staminal column. Female flowers: Sepals 3–6, petals 2–4, similar to those of the male flowers: carpel 1; style almost absent; stigma shortly lobed or 3–6-laciniate.

Drupe: Exocarp fleshy, glabrous; endocarp bony, compressed, horseshoe-shaped, dorsally tubercled, sides concave, often perforate. Seeds hippocrepiform, convex on the dorsal, almost plane on the ventral side; embryo embedded in fleshy albumen, hippocrepiform, terete; cotyledons incumbent, almost as long as the radicle.

Species 32.—Old World, chiefly tropical Africa. China and Malayan Islands.

Inflorescence papillose-puberulous, condyle perforate 1. *S. hernandifolia.*
Inflorescence glabrous, condyle not perforate ... 2. *S. japonica.*

1. **Stephania hernandifolia**, Walp. Repert. i (1842), 96; Hook. f. and Thoms. Fl. Ind. i (1855), 196, *partim*; F.B.I. i, 103, *partim*: Cke. I, 22, *partim*. Diels in Engler's Pflanzenr. iv, 94 (1910), 279.—*S. discolor*, Spreng. Syst. veg. ed. 16, iv, 2 (1827), 316, *non* DC.—*S. discolor* Spreng. var. *hernandifolia* Boerl. Cat. Pl. Bogor. (1899), 42.—*S. discolor*, Walp. Repert. i (1842), 96; Miers in Contr. Bot. iii (1871), 244.—*S. hernandifolia*. Walp. var. *discolor* Miq. Ann Mus. Lugd. Bat. iv (1868), 85; var. *pubescens* Teysm. et Binnend. Cat. Bogor. (1866), 173 —*S. japonica* O. Ktze. var. β *puberula*, O. Ktze. Rev. gen. i (1891) 10.—*S. Roxburghiana*, Miers in Ann. Nat. Hist. 3. Ser. xviii (1866), 14 n.n., in Cont. Bot. ii (1871), 224.—*Cissampelos hernandifolia*, Willd. Spec. pl. iv (1805), 861; DC. Syst. i (1818), 538, Prodr. i (1824), 100; Roxb. Fl. Ind. iii (1832), 482.—*C. Pata* Buch., *non* Roxb.—*C. discolor*, Wall., *partim*.—*C. hexandra*, Roxb. Fl. Ind iii (1832), 841.—*Cocculus Roxburghianus*, DC. Syst. i (1818), 516, Prodr. i (1824), 96, *non* Wall.—*C. Finlaysonianus*, Wall. Cat. n. 4974 (1828).—*Clypea discolor* Bl. Bijdr. (1825) 26.—*Cl. hernandifolia* Wight and Arn. Prodr. i (1834), 14; Wight Ic. t. 939 (1840).

Description: A slender twining shrub; branches thin, striate, sparingly pilose or glabrate. Petioles 3–6·5 cm. long; lamina peltate, thinly papyraceous, glabrous above, paler or glaucous below, with the nerves below floccose-puberulous, sometimes subtomentose, rarely glabrate, ovate, rounded at base, acute at apex or rarely obtuse and minutely mucronulate, 4–15 cm. long, 4–12·5 cm. broad.

Male umbels more or less puberulous, sometimes compound; peduncle 1·5–5 cm. long, often fuscous-puberulous; rays and raylets when present 3–8, producing globose-capitate cymules at the apex. Sepals 5–8, minutely puberulous on the outer side, elongate-obovate, 1–1·5 mm. long, 0·5–0·6 mm. broad, yellow; petals 3–4, broadly obovate, 0·7–0·8 mm. long; synandrium 0·5–0·7 mm. long. Female sepals 3–4, about 1 mm. long, 0·6 mm. broad; petals conchiform, about 0·8 mm. in diameter.

Drupe 6 mm. long, 4 mm. broad, compressed; endocarp with transverse ridges which are often spinulate on both sides, 5–6 mm. long, 4–5 mm. broad; condyle perforate.

Locality: *W. Ghats*: Khandalla (Herb. St. X. C!)—*Deccan*: Hills near Junnar (Herb. St. X.C. 18070!); Panchgani (Herb. St. X.C.!).

Distribution: Coast of Coromandel, Cachar, Sikkim, East Bengal, Assam, Penang, Siam, Malayan Islands, Australia.

Young fruit: September 1917 (Junnar).

2. **Stephania japonica,** Miers in Ann. Nat. Hist. 3. Ser. xviii (1866), 14 n.n., in Contrib. Bot. iii (1871) 213 ; O. Ktze. Rev. gen. i (1891), 9, *partim.—S. appendiculata*, Miers in Ann. Nat. Hist. 3. Ser. xviii (1866) 15 n.n., in Contrib. Bot. iii (1871), 221 —*S. intertexta*, Miers in Ann. Nat. Hist. 3. Ser. xviii (1866), 15 n.n., in Contrib. Bot iii (1871), 222 —*S. hernandifolia*, Miq. Prolus Fl. Jap. in Ann. Mus. Lugd. Bat. iii (1867), 108 ; Maximow. Mel. Biol. xi (1883), 643, tab. ii, 1–9, *partim.—Menispermum japonicum*, Thunb. Fl. Jap. (1784), 195.—*Cocculus japonicus*, DC. Syst. i (1818), 516.—*Clypea effua* Miers in Ann. Nat. Hist. 3 Ser. xviii (1866), 270 n.n., in Contrib. Bot. iii (1871), 207.—*Cissampelos psilophylla*, Presl, Reliq. Haenk. ii (1835), 80.

Description : A scandent glabrous shrub ; branches sulcate. Petioles 4–12 cm. long ; blade herbaceous or subpapyraceous, glabrous on both sides, below pale-glaucous, broadly ovate or subrotund-ovate, at base rotundate-acute, obtuse or subretuse at apex, 6–15 cm. long, 4·5–13 cm. broad ; primary and secondary nerves below slightly prominent ; veinlets reticulate, conspicuous, scarcely prominent.

Inflorescence glabrous. Peduncles 2·5–4 cm. long ; rays of the umbel 4–8, simple, rarely producing other umbels ; umbels or umbellules subcapitate. Male flowers : Sepals membranous, glabrous, 6–8, obovate-elliptic, 1·5 mm. long, about 0·7 mm. broad ; petals 3–4, broadly obovate, about 0·8 mm. long ; synandrium about 1 mm. long. Female flowers : 3–4, ovate—or obovate—elliptic, about 0·8 mm. long, petals 3–4, minute, subquadrate-obovate, about 0·4 mm. long.

Fruiting umbels larger and stouter ; peduncle up to 5 cm. long, rays of umbel 2–2·5 cm. long ; pedicels 5–7 mm. long. Exocarp red ; endocarp on both sides with a dorsal tubercled rib and with short transverse prominent ribs, 8 mm. long, 6 mm. broad ; condyle not perforate.

Locality : Konkan (Law ex Diels).—Deccan : Khandalla (Blatter and McCann 17475 !) ; Panchgani (Blatter !).

Distribution : Forests of the W. Ghats, commom from Coorg to Tinnevelly, up to 1800 m., Ceylon, Tenasserim, Central China, Japan, Philippines.

Flowers : July 1917 (Khandalla).

7. CISSAMPELOS Linn.

Species 21.—Warm regions of America, Africa, Asia, and N. Australia.

1. **Cissampelos pareira** L. Sp. pl. ed. 1 (1753), 1031 *ampl.* ; F. B. I. I (1872) 104 ; Cke. I, 122 ; Diels in Engler's Pflanzenr. iv, 94 (1910), 286.—*C. Caapeba* Roxb. Fl. Ind. iii (1832), 842.—*C. convolvulacea* Willd. Spec. pl. iv (1805), 863 ; Roxb. Fl. Ind. iii (1832), 842 ; Wight et Arn. Prodr. I (1834) 14.—*C. hirsuta*, Buch. ex DC. Syst. i (1818), 635.—*C. tetrandra* Roxb. Fl. Ind. iii (1832) 842.—*C. hernandifolia* Wall. Cat. (1828) 4979. *partim.*—*C. obtecta* Wall. Cat. (1827) 4981 F.—*Menispermum orbiculatum* Linn. Sp. pl. ed. 1 (1753) 341,—*Cocculus orbiculatus* DC. Syst. i (1818) 523.—*Cocculus villosus* Wall. Cat. (1828) 4957, *partim.—Batta valle* Rheede Hort. Malab. xi (1692) 127, tab. 62.

The above synonyms refer to what Diels calls var. *typica*, and they cover only the Asiatic forms of that variety. Diels characterizes his variety thus : ' *Foliorum lamina utrinque vel saltem subtus plus minusve pubescens, nonnunquam tomentosa, subtus pallidior, non glaucescens, plerorumque peltata. Drupæ patenti-pilosæ hispidulæ.*'

Diels has divided *C. pareiræ* into nine varieties. I do not think the time has come for distinguishing really good varieties. The plant is extremely variable and we possess too little in the way of field notes which alone will enable us to arrange the representatives of this protean species under natural groups.

Description : Cke. I, 22.

Locality : *Sind* (ex Duthie).—*Gujarat* : Godra (Herb. St. X. C. 18071 !).—*Khandesh* : Chauseli Hill, northern slope (Blatter and McCann 27100 !).—*Konkan* : Parsik Hill, Thana Distr. (Blatter and McCann 28911 !) ; Andheri ; Salsette (Blatter 18072 !) ; Kenery Caves, Salsette (Blatter and Hallberg 17461 ! 18936 !) ; Bassein (Blatter 17449 ! 17464) ; Bhandup (Blatter and McCann 17459!) ; Condita, Salsette (Blatter and McCann 17456 ! 18052).—*Deccan* : Gangapur, Nasik Distr. (Blatter 17464 !) ; Bhor Ghat (Blatter and

McCann 18058 !) ; hills near Junnar (Woodrow) ; Lonavla (Cooke !) ; Khandalla (Woodrow !).—*N. Kanara* (Talbot ex Cke.).

Flowers : June 1917 (Salsette) ; July 1917 (Salsette) ; August 1917 (Salsette); September 1917 (Nasik Distr., Thana Distr.) ; November 1916 (Salsette) ; December 1918 (Thana Distr.).

Distribution : Warm parts of America, East Africa and Asia.

Uses : *C pareira* and its relations form in the roots a substance called Bebirin. In nearly all the countries of their distribution they are used in medicine and very often their importance is exaggerated beyond their real value. *Cissampelos pareira* is official in the Addendum of the British Pharmacopœia as cissampelos in distinction from the root of *Chondrodendron tomentosum* R. & P., which is also official as pareira. The use of the name pareira both as a specific name and as a pharmaceutical title, in addition to its use as a vernacular name has led to a good deal of confusion.[1]

8. CYCLEA Arn. (Cke. I, 23.)

Of the 21 species known at present 2 occur in the Presidency. The descriptions given by Cooke characterize the two species correctly, but the names and synonymy have to be changed. Dunn, in the Kew Bulletin (1916), p. 60 gives an explanation of how the confusion came about : ' There appear to be three species of *Cyclea* in S. India, very similar in habit and in foliage, but differing in the structure of their male flowers. By far the commonest and widely diffused has globose or widely campanulate pubescent calyces, with 6-8 anther cells on the rim of it as peltate connective. This is the species described as *C. Burmanni*, Miers, in the Fl. Brit. Ind. i, 104. Miers did not use the combination in the place cited and Hooker f. and Thomson (Fl. Ind., 201) are the real authorities for this name, which is founded on *Cocculus Burmanni*, DC. (Syst. i (1818), 517). But Diels who had the opportunity of comparing a type with van Rheede's Malabar specimen previously described as *Menispermum peltatum* by Lamarck (Encycl. iv (1797), 96) considered the two to be identical, and, as Rheede's figure (Hort. Mal. vii. 49) quite agrees with this conclusion, Lamarck's specific name should be the one used. *Cyclea Burmanni*, Hook. f. and Thoms. and *Cyclea peltata*, Diels are synonymous and the fact that the combinations have been variously applied to three very different species in all the important works dealing with them during the last forty years has prepared the way for a complicated synonymy.

' The combination *C. Burmanni* was applied by all authors up to the time of Diels's Monograph to the common globose-flowered species ; to the second species having campanulate calyces and 4-5-celled androecia Hook. f. and Thomson wrongly applied the name *C. peltata*, while Miers (Contrib iii. 236) used the same combination, also wrongly, to designate a third species having the male calyx divided nearly to the base into 4-5 segments. The second species received the distinctive name of *C. Arnotti* from Miers (Contrib. Bot. iii. 238), while for the third which was collected by Beddome in the Wynaad and has not previously been separately recognized, I propose the name *C. fissicalyx*.'

Calyx globose or broadly campanulate, lobes ¼ of tube	... 1. *C. peltata*.
Calyx campanulate, divided nearly to the base	... 2. *C. fissicalyx*.

1. **Cyclea peltata,** Diels in Engler's Pflanzenr. iv, 94 (1910) 312 ; Gamble 31.—*C. Burmanni*, Hook. f. et Thoms. Fl. Ind. (1855), 201 ; Hook. f. F. B. I. i (1872), 104 ; Miers Contrib. Bot. iii (1871) 239, pl. 121; Cke. i, 23.—*C versicolor*, Miers in Ann. Nat. Hist. 3. Ser. xviii (1866), 19 n.n., in Contr. Bot. iii (1871) 240.—*Cissampelos discolor* Wall. Cat. (1828) 4892, *partim*.—*Cocculus peltatus*, DC. Syst. i (1818) 516, Prodr. i (1824), 96.—*Clypea Burmanni*, Wight and Arn. Prodr. Fl. Ind. i (1834), 14.—*Rhaptomeris Burmanni*, Miers in Ann. Nat. Hist. 2. ser. vii (1851), 41 n.n.—*Menispermum peltatum*, Lam. Encycl. iv (1797), 96 ; Willd. Spec. iv (1805), 827.—*Pada Valli*, Rheede Hort. Malab. vii (1688), 93, tab. 49.—*Smilax sp.* Burm Thes. Zeyl. (1737) t. 101.—Gaertn. Fruct. (1788), t. 180 f. 12.

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[1] See T. Holm., *Cissampelos pareira*. Merck's Rept. 27 (1918) 7–9, 60–61.

Description : Cke. i, 23.

Locality : *Khandesh* : Dadgaon (Blatter and Hallberg 27248 !).—*Konkan* : Borivli to Kenery Caves, Salsette (Blatter and McCann, 28993 !) ; Bhandup, Salsette (Blatter and McCann, 18064 !) ; Thana (Blatter and McCann, 8702 !) ; Penn (Blatter and Hallberg, 18074 !)—*Deccan* : Khandalla to Kampoli (Blatter and McCann 18059 !) ; Khandalla (Blatter and McCann, 18060 ! 17454 ! 18061 ! 18057 ! Blatter 18054 ! ; Igatpuri (McCann 17474 ! 17450 ! Blatter and McCann 18053 ! 17455 !—*S. M. Country* : Belgaum (Ritchie 976 ex Cke.)

Distribution : Western Peninsula, Ceylon, S. Andamans.

Flowers : January 1917 (Igatpuri) ; March 1917 (Khandalla) ; May 1917 (Khandalla) ; July 1916 (Khandalla) ; July 1918 (Thana) ; September 1917 (Igatpuri) ; November 1916 (Salsette) ; November 1917 (Igatpuri) ; December 1918 (Khandalla).

Fruit : November 1916.

2. **Cyclea fissicalyx.**, Dunn in Gamble 31, Kew Bull. (1916) 60.—*C. peltata*, Miers, Contrib. Bot. iii (1874), 236 ; Cke. I, 24 (*non* Hook. f. and Thoms, *neque* Diels).

Description : Cke. i, 24.

Locality : *W. Ghats* : Tingorwadi near Igatpuri (Blatter and Hallberg 18062 !) Khandalla (Blatter 18055 !). Apparently rare.

Distribution : W. Ghats of Bombay Presidency, forests of Wynaad in Malabar.

Flowers : January 1917 (Igatpuri).

(*To be continued*)

SNAKES COLLECTED IN BURMA IN 1925

BY

COLONEL F. WALL, C.M.G., K.H.S.

(*With a Block*)

My collection of snakes this year yielded 396 specimens, representing forty-eight species. Father Gilhodes sent me 129 specimens from Huton, in the Kachin Hills (4,500 ft.), and it is somewhat disappointing that among the 233 snakes collected by him in 1924 and 1925, no single specimen of the rare viper *Azemiops feæ* should have been obtained. It may be that it frequents an altitude above Huton. Among others who contributed to this years total, I have to thank Mr. P. M. R. Leonard ot Kutkai, North Shan States ; Mr. D. W. Lawson at Shweli North Shan States ; Major Rodrigues at Taunggyi in the South Shan States ; Major Cormack at Toungoo ; and Mr. Pudden, I. F. S., in the Tenasserim Province.

The following new species has been discovered. *Rhabdophis speciosus.*

The collection does not give an accurate estimate of the numerical strength of all the species, as I had to discourage those kind enough to work for me, from preserving large specimens, owing to the difficulty of sending spirit out to remote jungle localities. Such species as the larger *Coluber* and *Ptyas*, *Python*, *Naia*, and *Vipera russelli*, etc., were purposely rejected.

Family—TYPHLOPIDÆ.

Typhlops braminus. (Daudin).

Seven examples from Mandalay and Maymyo. Two of these measuring 75 mm. (3 in.) were killed in Maymyo in August and September. One was recovered from the stomach of a coral snake (Calliophis macclellandi).

Typhlops diardi. Schlegel.

Twenty specimens from Maymyo, and 20 from Huton, Kachin Hills.

Colour. One pale grey specimen was about to desquamate. The loose epithelium when removed revealed a pale grey colouration beneath, which tends to confirm my earlier observations (*Bombay Natural History Journal*, vol. xix, p. 609) entitling such specimens to the status of a colour variety under the name *cinereus.*

FOES. One was extracted from the stomach of a coral snake (Calliophis macclellandi).

GROWTH. (*a*) *The young.* Four measuring 96, 96, 98 and 100 mm. (3⅞, 3⅞, $3\frac{7}{16}$ and 4 in.) appeared to have been very recently born.

(*b*) *Early Life.* Specimens measuring 125 mm. (5 in.) in May, 138, 140, 150, and 160 mm. (5½, 5⅝, 6 and 6⅜ in.) in June, July and early August are clearly progeny of the previous year, and indicate a growth of about 50 mm. (2 in.) in the first year of life. Three specimens 216, 220 and 238 mm. (8⅝, 8¾ and 9½ in.) in May and July appear to represent broods of nearly two years growth, showing an increase of about 50 mm. (2 in.) in the second year of life.

(*c*) *Maturity.* A gravid female 238 mm. (9½ in.) long in May shows that the species is sexually mature before attaining an age of two years.

(*d*) *Maximum Length.* My largest was a female 418 mm. (1 ft 4½ in.).

BREEDING. (*a*) *Method of reproduction.* This year's collecting establishes the fact that this snake is viviparous. One killed in July contained four embryos that measured 44 mm. (1¾ in.) when unravelled. These were contained in sacs, and were clearly visible through the investing membranes.

(*b*) *The Brood.* Seven females were gravid, and contained from 4 to 14 eggs or sacs.

(*c*) *Season.* Four of the above contained very small eggs in May, others, eggs in a more advanced state in June and July, and the one containing sacs was killed on the 28th of July. Young of the year already alluded to measuring from 96 to 100 mm. (3⅞ to 4 in.) were killed in September.

Family—BOIDÆ.

Python molurus (Linné).

Four specimens from Zimba Chaung, Tavoy District; Sedaw 16 miles from Mandalay and from near Maymyo.

Habits. (*a*) *Disposition.* The one killed near Maymyo, 9 ft. in length was seen reclining on the ground and shot in jungle, and made no attempt to escape. The one killed in Tavoy, over 6 ft. in length was seen with its head beneath a rock, its body being too distended with a recent meal to permit further ingress to its retreat. This struck at the coolies who found it, and was despatched with a gunshot.

Food. The Tavoy specimen was enormously distended, and was found to contain a mouse deer (*Tragulus minimus*) in an advanced state of pregnancy.

Breeding. (*a*) *Sex.* The nine footer killed near Maymyo proved to be a male. The clasper is a cylindrical uniramic organ about 3 in. long, bifid at the extremity. It is encircled with loose folds, and has none of those recurved processes so characteristic of most Colubrine and Viperine species. At the base the anal glands contained an abundant secretion amounting perhaps to a drachm on each side, of an opaque dirty ochraceous fluid. Pressure squirted out a jet of this matter to a distance of about two feet.

(*b*) *Season.* Two juvenile specimens were found together at Sedaw on June 27, a fact which suggests that they had been recently hatched. One measured 628 and the other 685 mm. (2 ft. and ¾ in. and 2 ft. 3 in.).

Python reticulatus (Schneider).

The skins of five specimens, all killed in the Tenasserim Province, were sent to me for examination. The largest measured in life 13 ft. 3 in.

Lepidosis. *Costals.* Two heads-lengths behind the head 57, at mid-body 75, two heads-lengths before the vent 39. *Ventrals.* 308. *Subcaudals.* 90.

Family—ILYSIIDÆ.

Cylindrophis rufus (Laurenti).

One specimen from Sahmaw, Myitkyina District in the plains on the West bank of the Irrawaddy.

Lepidosis. *Ventrals.* 212. *Subcaudals.* 6 on left side, 7 on right. The 1st, 2nd, 3rd, 6th and 8th entire.

Family—XENOPELTIDÆ.

Xenopeltis unicolor (Reinwardt).

Two specimens, one from Toungoo, and one from Sawmah in the Myitkyina District.

Food. One contained a small frog in the stomach.

Family—COLUBRIDÆ.

Polyodontophis collaris (Gray).

Six examples all from Huton, Kachin Hills.

Food. A large skink (*Mabuia*) had been swallowed by one.

Breeding. Two females both killed before June 6 were eggbound. One of these measuring 506 mm. (1 ft. 8 in.) contained two very elongate eggs 35 by 6 mm. (1⅜ by ¼) in length. The other 584 mm. (1 ft. 11 in.) long, contained four eggs more than an inch in length.

Natrix khasiensis (Boulenger).

Synonymy. *Natrix gilhodesi* Wall. *Bom. Nat. Hist. Journ.*, vol. xxx, p. 587.

I have had 48 more specimens of this snake this year all from Huton, Kachin Hills. This further material compared with a long series of *khasiensis* from the Khasi Hills sent for my examination from the Indian Museum, Calcutta and Bombay collections, bridges over the apparent differences of my earlier specimens from the Kachin Hills, which led me to think these constituted a distinct species. The acquisition of three skulls, where last year I had but one, shows agreement with the dentition of Khasi Hills specimens.

Food. A single frog had furnished the meal in eleven subjects, and two frogs were extracted from the stomach of one.

GROWTH. (*a*) *Early Life.* Three specimens measuring from 232 to 272 mm. (9¼ to 10⅞ in.) in June, July and early August represent the broods hatched out last year. Twelve specimens from 386 to 436 mm. in length (15¼ to 17¼ in.) in June, July and early August appear to represent broods hatched out in the autumn of 1923.

(*b*) *Maturity.* Two egg-bound females measuring 430 and 436 mm. (1 ft. 5 in. and 1 ft. 5¼ in.) indicate that the species is sexually mature before attaining two years of age.

(*c*) *Maximum Length.* The largest male was 562 mm. (1 ft. 10¼ in.), and the largest female a similar length.

BREEDING. (*a*) *Method of Reproduction.* It is almost certainly oviparous, as eggs over an inch long have a tough white investment.

(*b*) *The Clutch.* No less than sixteen females were egg-bound, and contained from one to four eggs.

(*c*) *Season.* All the egg-bound subjects were killed in June, July and early August. It seems probable that eggs are not hatched out until the autumn.

Natrix trianguligera (Boie).

A single example was sent to me from Minhla in the Thayetmyo District and was killed on the banks of the Irrawaddy. This extends the previously know habitat, which until now was restricted to the Tenasserim Province.

COLOURATION. It is dark olive green with ill-defined and obscure quincunciate dark spots, less indistinct anteriorly. The belly is dirty white, the bases of all ventrals and subcaudals conspicuously black. There is a periocular buff zone, and the upper labials have black posterior borders.

LEPIDOSIS. *Ventrals.* 144. *Subcaudals.* 83.

DENTITION. *Maxilla.* Supports 27 teeth ; syncranterian, anododont, feebly coryphodont. *Palatine.* 24 ; feebly kumatodont. *Pterygoid.* 40 to 43 ; feebly scaphiodont. *Mandibular* 38 to 39 : feebly kumatodont.

Natrix venningi (Wall).

SYNONYMY. *Natrix nigriventer* Wall. *Bom. Nat. Hist. Journ.*, vol. xxx, p. 588. An unaccountable error in the description of *venningi* (*Bomb. Nat. Hist. Journ.*, vol. xx, p. 774) led to my describing *nigriventer* as a distinct species. In describing *venningi*, I recorded the costals as being disposed in 19 rows whereas they number only 17. In subsequent references to this snake, I have always looked up the printed description, and therefore perpetuated the error. Only recently I discovered that the scales are recorded as 17 invariably in my notebooks. The acquisition this year of a skull of *nigriventer* from the Kachin Hills, showed the dentition agreed with *venningi*, and led to the discovery of my mistake.

I acquired three specimens this year from Huton, Kachin Hills.

FOOD. One was found to have eaten two large and four small tadpoles.

BREEDING. A female killed before June 6, proved to be egg-bound and contained two large eggs 37 by 7 mm. (1½ by $\frac{5}{16}$ in).

LEPIDOSIS. *Costals.* In 17 rows in the whole body length. *Ventrals.* 155, 160, and 163. *Subcaudals.* 129, 134 and 143.

DENTITION. *Maxilla.* Carries 32 to 33 teeth : syncranterian, anododont, feebly coryphodont. *Palatine* 17 to 18 ; anododont, feebly kumatodont. *Pterygoid* 23 ? to 25 ; anododont, scaphiodont. *Mandibular.* 30 ? to 31 ? feebly kumatodont.

Natrix clerki (Wall).

A single specimen from Sinlum Kaba, Kachin Hills described by me in this journal (vol. xxx, p. 809).

Natrix bitæniata (Wall).

Five specimens all from Huton, Kachin Hills. Described by me in this journal (vol. xxx, p. 806). Has been confused hitherto with *Rhabdophis parallelus* (Boulenger).

Nerodia modesta (Günther).

Four specimens from Huton, Kachin Hills.

BREEDING. A female measuring 574 mm. (1 ft. 10¾ in.) killed between June 6 and August 12, contained three large eggs in the oviducts 35 by 10 mm. (1⅜ by ⅜ in.).

Lepidosis. *Ventrals.* ♂ 156 and 160, ♀ 149. *Subcaudals.* ♂ 118, ♀ 107.

Dentition. *Maxilla.* Carries 29 to 32 teeth; syncranterian, anododont, coryphodont, the last three slightly enlarged. *Palatine.* 18 to 20; feebly kumatodont. *Pterygoid.* 23 to 26; scaphiodont. *Mandibular.* 33 to 34; feebly kumatodont.

Nerodia piscator (Scheider).

Thirty-six examples from Rangoon, Shweli, Maymyo, and Huton, Kachin Hills.

Rhabdophis stolatus (Linné).

Fifty-three specimens from Maymyo, Kutkai, Shweli. North Shan States; Toungoo, Mandalay, Myitkyina; and Huton, Kachin Hills.

Food. A single frog found in the stomach of several.

Breeding. Three were egg-bound and contained from 7 to 11 eggs. Two of these were killed at Maymyo in June.

Rhabdophis subminiatus (Schlegel).

Seventeen were killed in Maymyo, one in Katha, and nine at Huton, Kachin Hills.

Food. One contained a toad, and two a single frog.

Growth. Young of the year were represented in Maymyo by one 275 mm. ($11\frac{1}{2}$ in.) in May, one 287 mm. ($11\frac{1}{2}$ in.) in June, one 240 mm. ($9\frac{5}{8}$ in.) in July, and one 323 mm. ($12\frac{3}{4}$ in.) in September. Broods hatched in 1924 were represented by one 475 mm. (1 ft. $6\frac{3}{4}$ in.) in March, one 562 mm. (1 ft. $10\frac{1}{4}$ in.) in June, one 562 mm. (1 ft. $10\frac{1}{4}$ in.) in August, and one 418 mm. (1 ft. $4\frac{1}{2}$ in.) in September. Broods hatched in 1923 were represented by three 710, 760, 785 mm. (2 ft. 4 in., 2 ft. 6 in. and 2 ft. 7 in.) in July, three measuring 735, 774 and 885 mm. (2 ft. 5 in. and 2 ft. 11 in.) in August. Hatchings of 1922 were represented by one 1165 mm. (3 ft. 10 in.) in May.

Breeding. No female was acquired in an egg-bound condition.

Rhabdophis speciosus (Wall).

This species described by me in this journal (vol. xxx, p. 734) was represented by three subjects all killed before June 6 at Huton, Kachin Hills. A ♂ measured 804 mm. (2 ft. $7\frac{3}{4}$ in.), another ♂ 710 mm. (2 ft. 4 in.) and a ♀ 614 mm. (2 ft. $\frac{1}{2}$ in.).

Lepidosis. *Ventrals.* ♂ 166 and 168, ♀ 167. *Subcaudals.* ♂ 86 and 87, ♀ 87.

Rhabdops bicolor (Blyth).

Three examples, all adult males from Huton, Kachin Hills. These measured 492, 512, and 518 mm. (1 ft. $7\frac{3}{8}$ in., 1 ft. $8\frac{1}{4}$ in., 1 ft. $8\frac{3}{8}$ in.).

Food. One had eaten what appeared to be a slug, and another an arachnoid with eight legs but devoid of any hair. The last segment of the limbs was compressed and had a few bristles beneath.

Lepidosis. *Ventrals.* 190, 191 and 192. *Subcaudals.* 54, 62 and 64.

The tongue of this snake is peculiar in having extremely long points, fully an inch from the point of bifurcation.

Trirhinopholis nuchalis (Boulenger).

Six specimens from Huton, Kachin Hills; and Kutkai and Maymyo in the North Shan States.

Length. The largest was a ♂ which taped 457 mm. (1 ft. 6 in.).

Breeding. A female captured before June 6, measuring 430 mm. (1 ft. 5 in.) proved to be egg-bound. The eggs, seven in number, measured 28 by 6 mm. ($1\frac{1}{8}$ in. by $\frac{1}{4}$ in.) and contained embryos that would be about 25 mm. (1 in.) long if unravelled.

Lepidosis. *Ventrals.* ♂ 124 to 130, ♀ 139 to 140. *Subcaudals.* ♂ 24 to 27. ♀ 23 to 26. In one the 2nd to the 5th were entire, and in another the 3rd was entire.

The testes in this species are remarkably large, being over an inch long.

Lycodon aulicus (Linné).

Six specimens from Mergui, Toungoo, Shweli in the Mongmit District, and Sahmaw in the Myitkyina District.

Food. One had swallowed a gecko.

Lycodon fasciatus (Anderson).

Eight examples from Huton, Kachin Hills and Maymyo. All the five Maymyo specimens were killed at dusk, or after dark, and in houses. Two had clambered up the masonry to an upper story.

FOOD. One had eaten a skink.

BREEDING. One female killed at Huton, Kachin Hills before June 6, contained 5 eggs in the oviducts, and another killed between June 6 and August 12, contained 4 eggs.

A slough found in a bathroom showed no traces of the black bands which are such a conspicuous feature of the species.

Ptyas mucosus (Linné).

Nine specimens from Maymyo and Taunggyi.

FOOD. A large toad had been eaten by one.

BREEDING. A female measuring 1930 mm. (6 ft. 4 in.) killed on April 23, contained eight large eggs in the oviducts.

Ptyas carinatus (Günther).

The skin of a large specimen measuring 2845 mm. (9 ft. 4 in.), tail 530 mm. (1 ft. 9 in.), killed by Mr. Pudden's coolies when in camp at Thebyn Chaung, Tavoy River, Tenasserim, was sent to me for examination.

COLOURATION. It is olive-brown dorsally with a series of light irregular and broken crossbars. In the posterior third of the body there are six black stripes which end at the vent. The uppermost of these involves the upper half of the 4th, the 5th, and lower half of the 6th rows. The median involves the contiguous halves of the 2nd and 3rd rows. The lowest involves the lower half of the ultimate row, and the edges of the ventrals. On the tail the scales are margined with black, leaving a round light ocellus in the middle. Belly yellowish with an irregular black median stripe.

LEPIDOSIS. *Rostral.* The rostro-nasal sutures are nearly twice the rostro-internasal and fully twice the rostro-labial. *Internasals.* A pair ; the suture between them rather less than half that between the praefrontal fellows. *Praefrontals.* A pair ; the suture between them about two-thirds the length of the frontal shield. *Frontal.* Touches 6 shields. *Supraoculars.* As long as the præfrontals and internasals taken together, a shade longer than the frontal, two-thirds to three-fourths the parietals. *Loreal.* One. *Praeocular.* One. *Postoculars.* Two. *Temporals.* 2+2. *Supralabials.* 10 ; the 1st and 2nd touching the nasals, the 5th, 6th and 7th the eye, and the 8th and 9th the lower anterior temporal. *Sublinguals.* The posterior rather longer than the anterior, in contact with the 6th and 7th infralabials. *Costals.* In 16 rows two heads-lengths behind the head to a point 3 or 4 heads-lengths behind mid-body where the 3rd and 4th rows blend. The scales further reduce to 12 about two heads-lengths before the vent, the 3rd row disappearing at this spot. Two median rows strongly keeled, and the next row feebly keeled in mid-body. Posteriorly four rows are strongly carinate. Apical facets paired. *Ventrals.* 212. *Anal.* ?. *Subcaudals.* 67 in pairs. (The tail may be slightly incomplete).

Zamenis korros (Schlegel).

One specimen from Fort Hertz in the Putao District.

Coluber porphyraceus Cantor.

Three specimens, one from Maymyo, one from Taunggyi, South Shan States, and one from Huton, Kachin Hills.

BREEDING. The one from Taunggyi killed before the 15th of June contained five eggs in an early stage of development.

Coluber prasinus (Blyth).

Four specimens ; two from Maymyo and two from Huton, Kachin Hills. One female measured 1,133 mm. (3 ft. 8¾ in.).

Coluber radiatus (Schlegel).

Four examples from Taunggyi, South Shan States ; Namtu, North Shan States ; Fort Hertz, Putao District ; and Huton, Kachin Hills.

Coluber oxycephalus (Boie).

The skin of one was sent to me by Mr. Pudden, I.F.S., killed at Yebusan, near Migyaunglaung, Tenasserim. This measured 2,410 mm. (7 ft. 11 in.), the tail (incomplete) 480 mm. (1 ft. 7 in.).

Dendrophis pictus (Gmelin).

Seven specimens, one from Huton, Kachin Hills, two from Maymyo and four from Mergui, Tenasserim.

Oligodon herberti (Boulenger).

One specimen from Huton, Kachin Hills.

Lepidosis. *Ventrals*. 206. *Subcaudals*. 36.

Oligodon theobaldi (Günther).

One specimen from Shweli, Mongmit District.

Oligodon albocinctus (Cantor).

Ten examples from Huton, Kachin Hills.

Food. Two were found to have feasted on ophidian eggs. In one there were four eggs of *Rhabdophis subminiatus* containing embryos measuring 175 mm. (7 in.). Another contained four eggs probably of *R. subminiatus*, the embryo measuring 125 mm. (5 in.). A third specimen had swallowed the eggs of a snake or lizard. One of these 25 mm. (1 in.) long was impacted in the mouth, and another had been swallowed.

Oligodon purpurascens (Schlegel).

Twenty-five examples from Maymyo, Namtu, and Shweli, North Shan States; Sahmaw, Myitkyina District; Toungoo; and Mergui.

Colouration. A fine series of twenty from Maymyo, exhibit a wonderful variety in colour and markings. Six of these conform to variety *cyclurus*, characterized chiefly by the absence of the quadrimacular crossbars so typical of variety *maculatus*. Both varieties ranged from a ground colour like a boiled prawn, through ruddy browns to a deep cigar brown. One specimen was a transitional form connecting the two varieties, by exhibiting very obscure, quadrimacular bars, fainty traceable in the posterior part of the body. The Mergui specimen conformed to variety *maculatus*.

Breeding. (*a*) *Method of Reproduction*. The size and character of eggs in the oviducts make it practically certain that the species is oviparous.

(*b*) *The Clutch*. Four egg-bound females contained respectively 6, 11 and 16 eggs.

(*c*) *Season*. Two were found egg-bound in May, and another in July, but the season probably extends over half the year judging from the growth of this year's specimens. Thus one example measured 470 mm. (1 ft. $6\frac{1}{2}$ in.) in March, and another 458 mm. (1 ft. 6 in.) in September. Again three specimens measured 600 mm. (1 ft. $11\frac{3}{4}$ in.) in April, one 595 mm. (1 ft. $11\frac{1}{2}$ in.) in May, one 575 mm. (1 ft. $10\frac{3}{4}$ in.) in June, one 575 mm. (1 ft. $10\frac{3}{4}$ in.) in July, one 584 mm. (1 ft. 11 in.) in August, and one 600 mm. (1 ft. $11\frac{3}{4}$ in.) in October. A specimen 192 mm. ($7\frac{5}{8}$ in.) long in October, was the only representative of this year's hatching.

Lepidosis. *Supralabials*. These are subject to great variation. The 2nd and 3rd, or the 4th and 5th are sometimes confluent. The 4th and 7th are sometimes cuneate and fail to reach the edge of the lip. The 4th is sometimes divided into an upper and a lower part. *Costals*. These are usually in 19 rows to just behind mid-body, and then become 17 owing to a confluence of the 4th and 5th, or 5th and 6th rows. In three specimens they were in 21 rows in parts. In all of these the 5th row divided and the resultant rows blended and redivided two or three times, before reducing to 19, and finally to 17.

Genitalia. These are diramic, and completely devoid of any of the recurved processes usually seen in Colubrines.

Oligodon splendidus (Günther).

One example from Mandalay. This was encountered by an orderly at night in the British Station Hospital, who narrowly escaped being bitten by it.

Liopeltis frenatus (Günther).

One specimen from Huton, Kachin Hills. This was a male with 163 ventrals and 95 subcaudals. The 2nd and 3rd infralabials were confluent on both sides.

Dipsadomorphus multimaculatus (Boie).

Six specimens from Maymyo and Toungoo. One was found coiled up in a letter box. One killed on December 7, had evidently retired into winter quarters selecting a hole in a log. An orderly carrying this on his shoulder from the stack to the house, had the disagreeable experience of seeing the snake gliding leisurely down his coat.

FOOD. One had swallowed a lizard of the genus *Calotes*.

BREEDING. A female killed on August 21, carried 7 eggs in the oviducts nearly fit for deposition.

Dipsadomorphus hexagonotus (Stoliczka).

Three specimens from Huton, Kachin Hills and Maymyo.

BREEDING. One killed between June 6 and August 12, contained three large eggs in the oviducts measuring over 50 mm. (2 in.) in length. A young one killed on August 30, measuring 330 mm. (1 ft. 1 in.) was evidently recently hatched.

LEPIDOSIS. *Costals*. The scales were in 19 rows at mid-body in all.

Psammodynastes pulverulentus (Günther).

Five specimens from Huton, Kachin Hills, and near Kya In, Amherst District (1,500 ft.).

FOOD. Two had swallowed a frog.

Chrysopelea ornata (Shaw).

Five specimens from Mandalay, Meiktila and Mergui.

One fell from the roof on to the tea-table among the assembled guests, and another was encountered at night on a staircase.

COLOURATION. The two Mergui examples were black with a centro-basal yellow spot on each scale. A series of vermilion spots on the spine from nape to vent. The head is barred black, and orange.

BREEDING. A female killed on May 23, was full of eggs, but having been shot to pieces these could not be counted.

Laticauda laticaudata (Linné).

One fine female from the Andamans measured 888 mm. (2 ft. 11 in.).

BREEDING. This contained five large sterile eggs in the oviducts measuring 43 by 18 mm. (1¾ by ¾ in.). The date of capture is not on record.

Bungarus fasciatus (Schneider).

Two specimens from near Taunggyi, South Shan States at 3,000 ft. elevation ; and Sahmaw, Myitkyina District. One encountered at night in a verandah wreathed itself round a servant's leg who managed to kick it off without being bitten. When searched for with a lamp, it was found in the low branches of a bush.

Bungarus multicinctus (Blyth).

Three specimens from Fort Hertz, Putao District ; and Ani Sakan near Maymyo (3,000 ft.).

One was killed at night in a house. One measured 1,040 mm. (3 ft. 5 in.) another 1,015 mm. (3 ft. 4 in.), and the third 1,028 mm. (3 ft. 4½ in.) The last when skinned and pegged out was 1,238 mm. (4 ft. and ¾ in.).

COLOURATION. One had 20 white bars on the body and 7 on the tail, and another 31 bars on the body and 10 on the tail.

FOOD. One contained a small mammal in the stomach.

GENITALIA. These are uniramic, cylindrical organs beset with small recurved processes.

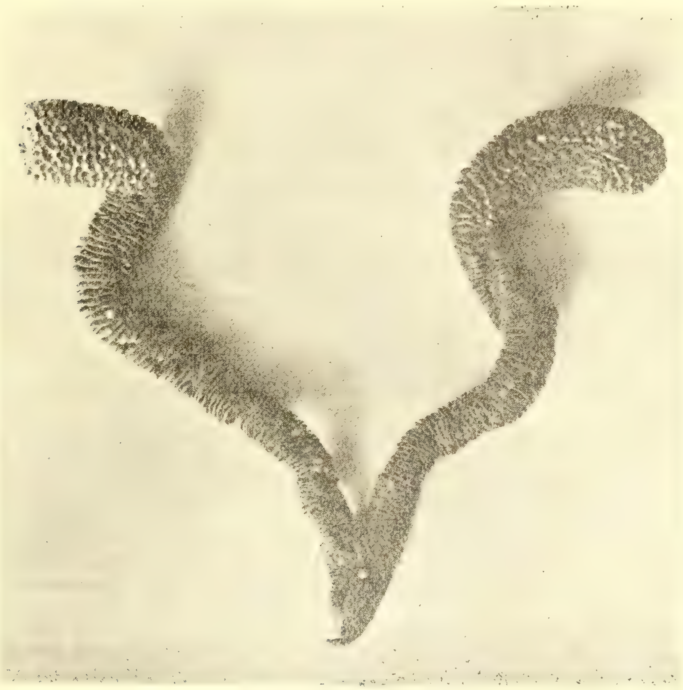
Naia hannah (Cantor).

Three specimens from Tenasserim ; and Shweli, Mongmit District.

One was chased up a stream and shot, another seen skulking in a bamboo clump was also shot. The third a hatchling, was observed moving about in a mysterious manner in a pool of water. Investigation proved that it was being firmly held by a fresh water crab. On being landed the crab released its grasp, and escaped leaving the snake almost dead on the bank. On examination I found the spine had been completely severed by the crab's claw.

Food. One measuring 2,515 mm. (8 ft. 3 in.) was found to have swallowed a large green snake.

Breeding. *Season.* The hatchling alluded to measure L. 538 mm. (1 ft. 9¼ in.). This was encountered on September 15, a date which considerably increases the previously known appearance of the young. The only other date that I am aware of being my own observation of hatching out at the end of May in the Nilgiri Hills.



The above photograph shows the male organ of the King Cobra to which reference was made in my recent paper on ('Snakes collected in Burma in 1924,' vol. xxx, No. 4, p. 820). A pair of hamadryads discovered *in copula* by Mr. Plunkett, I.F.S., were both shot by him ; they were dragged apart and the male organ was amputated and preserved in spirit. As stated in my previous article it appears to be a diramic organ of one side and is so markedly different from examples of these organs in the cobra (*Naia naia*) in my possession, as to justify *N. hannah* being placed in a distinct genus. Each limb of the organ is about 152 mm. (6 in. long), from the point of bifurcation to the extremity. A *raphê* passes up the posterior part. The basal four-fifths is surrounded by prominent transverse, somewhat imbricate folds resembling the gills of a mushroom. Most of the folds extend uninterruptedly right round the organ, others are discontinuous. In the distal fifth the folds are broken up to form a sort of honeycomb.

Lepidosis. *Ventrals.* 244. *Subcaudals.* 93 ; the first to the twelfth entire.

Naia naia (Linnè).

Three specimens from Impelet, 40 miles from Mandalay ; Namtu, North Shan States (2,000 ft.) ; and Myingyan.

Colouration. The Namtu specimen differs from all others with which I am acquainted. It is a young one of variety *fasciata*, measuring 388 mm. (1 ft. 3¾ in.). It is black with narrow white bars growing more and more distinct posteriorly. The bars are interrupted over the spine. The belly is black with white bars anteriorly growing fainter posteriorly.

A specimen of variety *fasciata* of a similar length from Myingyan is a uniform light olive-brown, thus conforming to the type usually seen in Burma.

Calliophis macclellandi (Reinhardt).

Eight specimens from Maymyo all of variety *macclellandi.*

One specimen was found at night on a staircase. One caught on the road at night was sent to me alive and unscathed. It proved a very lively creature when liberated, making repeated endeavours to escape. When arrested with a stick it flattened the whole body to a very remarkable degree.

FOOD. One had swallowed a large *Typhlops diardi*, and another a full grown *Typhlops braminus.*

BREEDING. A female measuring 598 mm. (1 ft. 11½ in.) killed on July 8 contained fourteen eggs in the oviducts, with embryos that measured about 25 mm. (1 in. in length).

Family—AMBLYCEPHALIDÆ.

Amblycephalus macularius (Theobald).

Four specimens from Kalaw, South Shan States; Maymyo and Shweli, North Shan States; and Huton, Kachin Hills.

HABITS. One of these was found beneath a stone, and when touched made no attempt to escape, but curled itself into a knot. Another juvenile specimen was also dislodged from beneath a stone.

FOOD. One had swallowed two slugs.

GROWTH. A young one measuring 140 mm. (5⅝ in.) was killed on August 2.

LEPIDOSIS. Agrees in the following points in all. *Praeocular.* One. *Subocular.* One, crescentic. *Postocular.* One. *Supralabials.* 7, the 1st and 2nd touching the nasal, the 2nd, 3rd. 4th and 5th the subocular, and the 5th and 6th the lower anterior temporal; 7th very long equalling the 4th, 5th and 6th taken together *Temporals.* In one specimen the two upper were confluent on the right side forming a very long shield. In this respect it agrees with the type of *A. andersoni*, a form I consider should rank as *macularius* (Rec. Ind. Mus. 1922, p. 24). *Ventrals.* ♂ 142 to 150, ♀ 163. *Subcaudals.* ♂ 39 to 42, ♀ 41.

DISTRIBUTION. One specimen taken at Shweli at about 800 ft. close to Hills that ascend to over 3,000 ft. All the other localities are over 3,000 ft.

Family—VIPERIDÆ.

Trimeresurus gramineus (Shaw).

Nine specimens from Toungoo; Maymyo and Muse, North Shan States; Sahmaw, Myitkyina District; and Huton, Kachin Hills.

HABITS. One brought to me alive moved in a remarkable manner. It threw forward its body, and then advanced the head and forebody till straight, and repeated the action. It thus appeared to progress sideways, and did so in a laboured fashion. This struck viciously at a stick, and also at the forceps used when trying to grasp its neck. One lying in the grass wreathed itself round the hand of a grass cutter and struck at him, but failed to implant its teeth.

One was found beneath a stone, and another reclining on a post.

FOOD. One had swallowed a small mammal.

LEPIDOSIS. *Costals.* All had the scales in 21 rows at mid-body.

GENITALIA. These organs are diramic, and smooth except at the tips where there are small recurved processes.

EYES. These in a live specimen were a brilliant ruby-red.

SKIN. This is remarkably loose, so that when pegged out the interspaces are broader than the scale rows. The beautiful vivid green fades to black within an hour or two of its removal.

Trimeresurus monticola (Günther).

Five juvenile specimens from Huton, Kachin Hills, killed in June, July and August. Three measuring 208 227 and 245 mm. (8¼, 9 and 9¾ in.) appear to be this year's production.

A CONTRIBUTION TO THE ORNITHOLOGY OF DELHI

BY

THE LATE S. BASIL-EDWARDES, M.B.O.U., R.A.O.U.

PART II

(*Continued from page 273 of this volume.*)

Liopicus mahrattensis (Lath.). The Yellow-fronted Pied Woodpecker.

This bird is not very common at Delhi. An ad. ♀ obtained on January 24, 1925, and another of the same sex seen at Kingsway on the same day. On January 31, 1925, another ♀ was obtained. No ♂♂ were seen. Freshly shot birds have a pleasant woody smell.

Brachypternus aurantius aurantius (L.). The Northern Golden-backed Woodpecker.

Common. Two or three pairs are generally to be seen on the trees on any of the roads leading out of Delhi. Seen in the larger gardens.

Iynx torquilla torquilla (L). The Wryneck.

Not uncommon in thin babool jungle; but a most unobtrusive species. Four specimens obtained at various times proved to be of the typical race.

Xantholæma hæmacephala indica (Horsf. and Moore). The Indian Crimson-breasted Barbet.

Common, but not seen much during the winter. It became quite conspicuous as soon as the weather warmed up by the middle of February, and throughout March birds were sure to be heard calling or to be seen feeding on peepul fruit.

[Eggs taken by Bingham. March–April.]

The *District Gazeetter* states that 'Barbets of several kinds' are found in Delhi; but I did not meet with any other species.

Coracias benghalensis benghalensis (L.). The Northern Indian Roller.

Abundant. Most birds had begun nesting operations about the time I left Delhi

[Eggs taken by Bingham. May–July.]

Merops orientalis orientalis (Lath.). The Common Indian Bee-eater.

Very common. Several pairs were seen breeding towards the end of March. Two pairs were excavating nesting-holes in a dry drain just outside the gate of my house.

[Eggs taken by Bingham. April–May.]

Merops superciliosus javanicus (Horsf.). The Blue-tailed Bee-eater.

I have a recollection of seeing this species in 1921–22 at Kingsway. I saw no specimens in 1924–25, though I watched carefully for them towards the end of March and the beginning of April, visiting likely places without success.

[Eggs taken by Bingham. Beginning of May.]

Merops persicus persicus (Pall.). The Blue-cheeked Bee-eater.

I left Delhi long before the arrival of this fine species. Bingham's note is worth reproduction and I cannot do better than quote it. He writes :—

'This large and handsome Bee-eater makes its appearance at Delhi, and in the districts to the south and west, in the end of April; at first in small numbers, but about May in immense flocks. About Delhi itself they breed sparingly, chiefly in high sandy banks near the Jumna; but at Sultanpoor, near Gurhi Hursaroo, on the Rajputana State Railway line in great numbers. The breeding season lasts from the middle of May to the middle of July, the

Merops persicus persicus.—(*contd.*)

last eggs I took being on the 9th of the latter month ; but most nests contain young by the end of June. Five is the greatest number of eggs I have found in any one nest, and this only on two occasions ; the usual number laid I think is three or four.

' The depth of the nest-holes varies from 3 to 7 feet ; in diameter they vary from 2 to 3½ inches, and the tunnel almost invariably has a slight inclination upwards, with an occasional divergence to the right or left, and ends in a chamber about 9 in. in length 4 in. in breadth, and 4 in. in height. This is never lined, the eggs being laid on the bare ground. In such nests as I have been unlucky enough to dig out and found tenanted by young ones, I found the remains of grasshoppers, locusts, and other insects, strewing the floor of the chamber. I was glad to find that these latter nests, though ruined, were not deserted by the old birds ; but the young fed and taken care of till able to fly.'

Ceryle rudis leucomelanura (Reichenb.). The Indian Pied Kingfisher.

Common near canals and the riverside, and pieces of open water. Cole obtained eggs as follows :

(*a*) January 3, 1925. Four young about two days old.
(*b*) February 5, 1925. Nest with one egg.
(*c*) ,, 6, 1925. Nest with five fresh eggs.
(*d*) ,, 7, 1925. Nest with three fresh eggs.
(*e*) March 10, 1925. Nest with five very hard-set eggs.

[Eggs taken by Bingham. March.]

Alcedo atthis bengalensis (Gmelin.). The Common Indian Kingfisher.

The occurrence of this race in Delhi is of some interest. Unfortunately I obtained only one specimen of each race and I cannot state which is the commoner bird of the two.

Alcedo atthis pallasii (Reichenb.). The Central Asian Kingfisher.

A couple of small Kingfishers shot at Kingsway on November 16, 1924, proved to examples of *pallasii* and *bengalensis*. These little Kingfishers are common along canal-banks, etc.

Halcyon smyrnensis (L.). The White-breasted Kingfisher.

A common species. As is the case with this Kingfisher it is often far from water. Observed on trees on the roadside at Raisina, among trees on the Tis Hazari grounds, and other places. It appears that *smyrnensis* and *fusca* meet in about the neighbourhood of Gurgaon, and without a series for comparison, I prefer to treat the bird binomially.

[Eggs taken by Bingham. Month not mentioned.]

Lophoceros birostris (Scop.). The Common Grey Hornbill.

Fairly common. Seen in previous years at Kingsway. A party of four or five seen on the outskirts of Raisina on December 26, 1924. A specimen obtained on that day was found to be coated with fat. Seen again the next day among the trees on the Tis Hazari maidan. A pair observed near the Jantar Mantar on March 5, 1925 and another specimen secured (sex ♂). From time to time Hornbills used to visit a large peepul tree growing opposite my house. This species is frequently seen in large gardens on *Ficus* trees. The call is a loud harsh cry, very like a scream of distress. Another note sounds much like that emitted by *Milvus m. govinda*.

Upupa epops epops (L.). The European Hoopoe.

Upupa epops orientalis (Baker.) The Indian Hoopoe.

Both races were common during my stay in Delhi. By the middle of March the latter race was breeding. I saw many birds disappearing into crevices of walls in buildings and ruins that abound in Delhi. A breeding ♂ shot on March 29, 1925, has an extraordinarily long bill (80 mm.). Cole took a nest with seven fresh eggs on March 5, 1925.

[Eggs taken by Bingham. ' An early breeder. Hard-set eggs by first week of April.']

Micropus affinis affinis (Gray). The Common Indian House Swift.

Breeds in numbers in the eaves of houses, in temples, tombs, under bridges, etc. A specimen was caught by hand in the Secretariat on March 31, 1925. Dozens breed in crevices in the corridors of this building.

[Eggs taken by Bingham. March-April and August.]

Caprimulgus asiaticus (Lath.). The Common Indian Nightjar.

I kept a keen watch for *Caprimulgidae* but met with none. Cole was lucky enough to procure a pair of specimens of this species on February 5, 1925. He met with the birds in bare, open country which had been flooded over when the river rose. The vegetation was very scanty there, and consisted of a few tufts of long grass and one or two babool trees. It is possible that the birds were inclined to breed : unfortunately, the genital organs of the specimens obtained by Cole were not properly examined.

Hierococcyx varius (Vahl.). The Common Hawk-Cuckoo.

None were seen or heard till March 14, 1925, on which date I found three or four pairs in babool jungle, and obtained an ad. ♂. Most of the birds were emitting the trilling note and only one was heard uttering the 'Brain-fever' call. Later on, up to the end of my stay in Delhi, the 'Brain-fever' note was commonly heard.

Clamator jacobinus jacobinus (Bodd.). The Pied Crested Cuckoo.

Bingham says that he took several eggs suspected to be those of this Cuckoo in nests of *Argya malcolmi* ; but it is not clear whether these were taken in Delhi or not. Bingham may be referring to his experiences in Allahabad. I did not see this Cuckoo during the period I was in Delhi, but it probably comes in during the rains.

Eudynamis scolopaceus scolopaceus (L.). The Indian Koel.

I think I saw a ♀ towards the end of my stay in Delhi. I left before this Cuckoo had come in.

Tacoccua sirkee sirkee (Gray). The Punjab Sirkeer Cuckoo.

Not uncommon, but a most inveterate skulker and a silent bird. Its unobtrusive habits make it appear less common than it really is. This curious Cuckoo bears an astonishing resemblance to a Mungoose when seen for the first time on the ground. Mr. E. H. N. Gill has also noticed the resemblance (*J. B. N. H S.*, vol. xxx p. 283). This bird is capable of running along the ground at a great pace, stretching out its neck and crouching low to attain speed. When disturbed it can make itself scarce in no time, taking advantage of every bit of cover to escape observation.

[Eggs found by Bingham on canal-banks at Delhi on April 4.]

Centropus sinensis sinensis (Steph.). The Chinese Crow-Pheasant.

Common in thick babool jungle, long grass, and tangled undergrowth in gardens. None were heard calling in winter ; but by the end of March the weird, ventriloquistic hooting of this bird was heard daily. A specimen shot on January 11, 1925, measures : wing about 195 mm., tail about 345 mm. and total length about 575 mm. Mr. Whistler has identifies this bird as being of the above race.

Psittacula torquata (Bodd.). The Rose-ringed Paroquet.

Abundant. Numbers are to be seen among the ruins which abound in Delhi.

[Eggs taken by Bingham. February-March.]

Psittacula cyanocephala cyanocephala (L.). The Western Blossom-headed Paroquet.

I do not think that this pretty little Paroquet is rare in the Delhi Province ; but it is seldom seen as it haunts open country away from human habitation and buildings. Five birds seen on February 8, 1925. and a juv. ♂ shot. This bird was unfortunately too damaged to preserve. Four birds seen flying over on March 21, 1925. This species can easily be recognized in the field from *torquata* (*a*) by its smaller size, (*b*) by its swifter flight, (*c*) by its call-note, which is a soft, pleasing *jo-ee*, *jee*, quite unlike the harsh screams of the larger species. Numbers are brought round for sale.

Bubo coramandus (Lath.). The Dusky Horned Owl.

Seen at Dusk among trees on the less frequented roads and along the Ridge near the riverside. Occasionally a bird perches on the roof of one's house. This fine Owl is not infrequently seen in broad daylight perched quietly in a clump of trees. This bird after the manner of other Owls, snaps its mandibles together in a most terrifying manner with a loud sound. A specimen was brought to me in a much mangled state. The flesh and bones of this Owl are supposed to be of some medicinal value. The call has been aptly described by Butler, and is commonly heard at dusk.

[Eggs taken by Bingham, 5th January.]

Bubo bengalensis (Frank.). The Rock Horned Owl.

This large Owl is also found in Delhi.

Tyto alba javanica. (Gmel.) The Indian Barn-Owl.

I heard a Barn-Owl on the night of March 30, 1925.

Carine noctua brama (Temm.) The Indian Spotted Owlet.

Abundant at dusk along the telegraph wires on the roads. I have noticed this species hover as described by Mr. G. O. Allen (vide *J.B.N.H.S.*, vol. xxvi, p. 1045) and by Messrs. Fletcher and Inglis in their book entitled *Birds of an Indian Garden*. (p. 158). The habit has also been noticed by Messrs. Whistler and Jones.

This Owlet is found in holes and crevices in most of the ancient buildings in Delhi. I did not collect any eggs in 1925, but I obtained two clutches of four eggs each on March 8, 1922, in holes of trees on the roadside at Kingsway.

[Eggs taken by Bingham. March–April.]

Otus sunia sunia. The Indian Scops Owl.

On March 22, 1925, while out collecting birds in a babool jungle at Raisina, I had good fortune to meet with this Scops Owl. Having shot some birds and a hare, I was resting with a friend under a babool tree when my attention was drawn to a pair of *Tephrodornis pondicerianus*. On getting up to watch these Wood-Shrikes, I noticed a long reddish-brown object among the topmost branches of a small kikar tree. At first sight this looked like a dried fruit of some sort, but its curious shape and colour, and the fact that it was on a kikar tree, caused me to take another view of it. When I did so and went round to the other side of the tree, I was astonished to find that I saw looking at a Scops Owl. The bird was easily obtained, it must have been in that spot all the time we were under it! This was the only specimen I saw in Delhi. Mr. F. H. Cole obtained another—a ♀—in the Kudsia Gardens in the Old Delhi on February 26, 1925. An examination of the genital organs of my bird showed that it was an ad. ♂ about to breed. These two specimens belong to the race *Otus s. sunia*. The ♀ obtained by Cole differs from my ♂ in having the lower part of the throat and the breast a rufous colour, and the stippling on the sides of the abdomen less distinct.

Both are in the typical 'cinnamon-bay' phase.

Of the thirty specimens examined by Dr. Ticehurst in the British Museum none are from Delhi.

The *District Gazetteer* mentions the occurrence of 'Owlets of several descriptions.' I met with no Owls other than those noted above, but from a description of an Owl given to me it appears that some other species of Scops Owl is also found in Delhi.

Torgos calvus (Scop.). The Black, King or Pondicherry Vulture.

Seen on several occasions.

[Eggs taken by Bingham. 28th February.]

Gyps fulvus fulvescens (Hume). The Indian Griffon Vulture.

Bingham records the finding of a nest of this Vulture in the following words :—

'On March 18, I found a nest of this Vulture placed on a solitary peepul, standing in the middle of a plain not far from the left bank of the Jumna, opposite the village of Wuzeerabad. The nest was a large rough unlined structure of boughs and branches, larger than, but very like that of, *P. bengalensis*. It contained a single hard-set dirty-white egg, which measured 3·78 by 2·68 inches. I shot the old female as she moved off the nest.' This

Gyps fulvus fulvescens—(*contd.*)

may refer to the village of Wazirabad near Delhi. I have no record in my note-book of having seen this species.

Pseudogyps bengalensis (Gmel.). The Indian White-backed Vulture.

A large number of breeding birds were seen on the way to Ambala on April 3, 1925. Almost every peepul tree held one or two nests, and some trees held four or five nests. Cole obtained eggs as follows :—

(*a*)	November 15, 1924.	One hard-set egg.
(*b*)	do. 21, 1924.	One fresh egg.
(*c*)	do. 24, 1924.	One hard-set egg.
(*d*)	do. 25, 1924.	One fresh egg.
(*e*)	do.	One slightly hard-set egg.
(*f*)	December 22, 1924.	One slightly hard-set egg.
(*g*)	do.	One slightly hard-set egg. This egg was taken from the same nest as held a fresh egg on November 21, 1924.
(*h*)	December 25, 1924.	Nest containing young.

[' At Delhi these Vultures have several breeding-places on both the Eastern and Western Jumna Canals.' (Bingham).]

Neophron percnopterus subsp.? White Scavenger Vulture.

White Scavenger Vultures are very common at Delhi, especially on the outskirts of the City and just outside villages. I took an unmarked white egg from a nest built in a large peepul tree in Old Delhi on March 28, 1921.

Blanford says (*Fauna of British India*, Birds, vol. iii, page 327) : ' This (*percnopterus*) replaces the last species in the extreme north-west of India, and is the common bird of the Punjab, Sind and Cutch, extending east to Delhi ; farther east than this the yellow-billed birds prevail.'

It is probable then that both *ginginianus* and *percnopterus* occur in Delhi ; but I have not been able to verify this definitely. At present, therefore, I am unable to give the status of the two birds in Delhi.

[Eggs taken by Bingham. February–March.]

Aquila nipalensis nipalensis (Hodg.). The Eastern Steppe Eagle.

Seen throughout the winter, though hardly any were noticed in March. I once surprised a bird which was feeding on the ground in babool jungle.

Aquila rapax vindhiana (Frank.). The Indian Tawny Eagle.

This species was seen from time to time. I watched a bird feeding on some meat on March 26, 1925, and, having seen one haunting the same locality, I presume it was breeding nearby. On January 4, 1925, Cole found a nest in the Kudsia Gardens with two fresh eggs.

Aquila hastata (Less.). The Small Indian Spotted Eagle.

Eggs taken by Bingham, who writes : ' On May 14 I found a nest of this Eagle placed on an immense babool tree on the banks of the Nezzufgarh Escape Canal, where it passes through a number of gardens under the Ridge at Delhi . . . '

Hieraetus fasciatus (Vieill.). Bonelli's Eagle.

I did not observe this Eagle. Cole saw it at Tughluqabad on December 27, 1924. Hume mentions that he found a nest at those ruins.

Ictinaetus malayensis perniger. (Hodg). The Indian Black Eagle.

In the winter of 1920–21 I saw an undoubted specimen of this fine Eagle on the river-banks at Kingsway.

Butastur teesa (Fruh.). The White-eyed Buzzard-Eagle.

Fairly common. The stomach of an ad. ♀ shot on November 4, 1924, contained a lizard and the remains of some large insects.

Cuncuma leucorypha (Pall.). Pallas's Fishing-Eagle.

I saw a fine specimen of this Fishing-Eagle on November 26, 1924, at Okla, but was unable to obtain it. On January 11, 1925, I saw a pair in the same place, and I was fairly certain that they were nesting there in one of the larger

Cuncuma leucorypha.—(*contd.*)

trees. Cole found the nest later, on February 3, 1925. It was on a tall cotton tree and then contained young.

Polioætus ichthyætus (Horsf.). The Large Grey-headed Fishing-Eagle.

I saw a fine specimen of this species at Okla, on November 26, 1924, but though fired at it got away. I did not meet with the bird again.

Milvus migrans govinda. (Sykes.). The Common Pariah Kite.

Observed many nests in February and March. Cole took three fresh eggs on February 17, 1925.

[Eggs taken by Bingham. March–April.]

Elanus cœruleus cœruleus (Desfon.). The Black-winged Kite.

Saw a pair at Raisina beating over scrub-jungle and babool trees, and obtained the ♂. Three seen on November 16, 1924, at the back of the Secretariat in Old Delhi. One of these birds appeared to be a young one. A pair seen beating over the Ridge at Raisina on March 25, 1925. These birds were being badgered by Crows.

Circus macrourus (Gmelin.). The Pale Harrier.

Not common. A ♂ was obtained on November 13, 1924, beating over scrub-jungle and grass-land. The stomach contained a lizard's tail and insect remains. Another specimen seen flying over my house on November 24, 1924.

Buteo ferox (Gmel.). The Long-legged Buzzard.

A solitary bird used to frequent a patch of open ground just opposite my residence. Another bird would haunt a memorial column close by, and this bird was eventually shot on February 24, 1925. It proved to be an ad. ♀ in the pale phase. A toad was taken from her bill, and the stomach contained a half-digested rat of some species. Scores of curious-looking parasites came off this specimen when it was being skinned! The Long-legged Buzzard is generally to be found in favourite spots haunting the same place day after day. Most of the birds seen were in the pale phase, and I remember seeing only two birds in the dark plumage.

Astur badius dussumieri (Temm.). The Shikra.

A fine ad. ♂ obtained on December 11, 1924, and an ad. ♀ on January 24, 1925. The latter bird had just caught a Palm Squirrel and was preparing to have a meal when she was shot. The squirrel immediately scampered up the tree, apparently none the worse for his experience! The colour of the claws of this common species is black.

Falco tinnunculus tinnunculus (L.). The Kestrel.

A ♀ seen on the roadside on December 13, 1924. Two others, both ♀♀ I think, seen near the Secretariat at Raisina on February 17, 1925. One of these was obtained. Mr. A. E. Jones has identified this bird as a specimen of the typical race.

Falco *sp* ?

A ♀, judging from its large size, used to frequent the towers of the Secretariat at Delhi. This bird would take a regular and heavy toll of *Columba l. intermedia*. A friend once saw it capture a *Cercomela fusca*. The capture of a Pigeon was notified by the Falcon's loud screaming. It was generally to be seen perched on a tower, scattering the feathers of its recently captured prey far and wide. The Indians called it a *Bhyree*. I understand that one or two are usually to be seen in favourite spots. Two are usually to be seen at favourite spots. On one occasion I visited one of these spots, but I saw no bird. A specimen was seen near my house on April 2, 1925.

Falco chiquera chiquera (Daudin). The Red-headed Merlin.

On January 6, 1925, I saw a pair perched on a large peepul tree opposite my residence. I shot the ♂, a beautiful specimen, with my ·410 bore walking stick gun; but the ♀ flew off in alarm and I did not get her. She was seen again on a low babool tree, but was far too wary to shoot.

[Eggs taken by Bingham. March 27.]

Crocopus phoenicopterus, *subsp.*? Green Pigeon.

Not uncommon in suitable localities, but I did not meet with any personally and am therefore not sure of the subspecies to which they belong. I am told that Green Pigeons visit the peepul trees in the District Jail. A few stray birds were shot by a friend close to his house in Old Delhi. These birds were feeding on peepul fruit.

Columba livia intermedia (Strick.). The Indian Blue Rock-Pigeon.

Large numbers are to be seen in the heart of the city, in the Chowk and in other streets in the Indian quarter. Breeds in numbers among tombs and ruins. Several pairs breed in a deep well on the Ridge at the back of the Balak Ram Hospital. I have come across enormous flocks containing several hundreds of birds, near Kingsway Station.

Streptopelia chinensis suratensis (Gmel.). The Indian Spotted Dove.

Specimens of this species are sometimes met with, but are likely to be overlooked among the vast numbers of *Streptopelia d. decaocto* which abounds in Delhi. I would describe the call of this Dove as a plaintive, gurgling coo, which may be represented as *coo-coo*, *cōōr-rr-roo*, *cōō-rr-rōō*. *Cōō-rr-rōō*.

Streptopelia senegalensis cambayensis (Gmelin.). The Little Brown Dove.

Both this species and *Streptopelia d. decaocto* are often seen together. The coo of this Dove is very characteristic. It has several notes and may be represented as *cōō-cuk cuk-cōō-cōō-cōō-cōō*, the second and third syllables being accentuated and pitched higher than the first, and the remainder of the call being uttered quickly. Breeds from February onwards. I have taken eggs in that month, and Cole found a nest with two fresh eggs on February 17, 1925.

[Eggs taken by Bingham. March-August.]

Streptopelia decaocto decaocto (Friv.). The Indian Ring Dove.

Abundant and by far the commonest Dove in Delhi. It may be seen in numbers all over along with the species last mentioned. Both are found feeding in parties and small flocks in the early mornings and evenings, retiring to the shelter of babool and other trees during the heat of the day. I found this Dove a great nuisance when collecting birds in babool jungle. Birds would dash out in ones and twos from every tree with such a flutter and whistling of wings that anything worth getting was immediately frightened off. Besides the coo, this Dove utters a harsh squaking note. The coo of this species is a trisyllabic one—*cōō-cōō-kuh*, repeated several times. Throughout the months of February and March the Ring-Dove was found breeding, and wherever one looked, ♂♂ were to be observed displaying. Most nests are built fairly low down on babool trees.

[Eggs taken by Bingham. All the year round.]

Oenopopelia tranquebarica tranquebarica (Herm.). The Indian Red Turtle-Dove.

Not common. Seen occasionally, feeding in company with *Streptopelia d. decaocto*, the males being easily recognized by the grey head and reddish colour. This Turtle-Dove was noticed on the railway journey between Delhi and Ambala on April 3, 1925. It should be remembered that this refers to the winter. This Dove is probably a summer visitor in Delhi.

One of the most noticeable features of the bird-life of Delhi is the abundance of Doves there.

Pterocles orientalis (L.). The Large, Black-bellied or Imperial Sand-Grouse.

Found in flocks in suitable localities. May be seen at favourite drinking-places.

Pterocles indicus (Gmel.). The Painted Sand-Grouse.

The following extract regarding the distribution of this Sand-Grouse is taken from *Nests and Eggs*, vol. iii, p. 364: 'Throughout the so-called Mewat Hills and the Aravallis which run down from Delhi to Mount Aboo, a broad straggling broken belt of stony, detached; and often barrow-like hills, they are common.'

Pterocles senegalensis erlangeri (Neum.). The Common Indian Sand-Grouse.

Also common in suitable localities. Several seen on February 17, 1925, in small parties in dry, open ground on the outskirts of Raisina. A ♀ which was preserved had her crop full of tiny, hard, gritty, pinkish-red seeds. Only two pairs seen when I visited this place again on February 21, 1925. A pair was shot and the ♂ made into a skin.

Pavo cristatus (L.). The Common Peafowl.

Common enough near villages and cultivation all over Delhi. Seen at Raisina where it was very common when I first arrived. On November 15, 1924, I saw a family party in which there were three or four birds about the size of a domestic fowl. After a short while, by the end of November, the birds disappeared from this locality and during the rest of my stay in Delhi were not seen at Raisina again.

Coturnix coturnix coturnix (L.). The Common Quail.

Common in suitable country. A stray specimen was flushed in an open patch of ground opposite my residence on December 29, 1924—a most unlikely place for Quail.

Francolinus francolinus asiæ (Bonap.). The Northern Indian Black Partridge.

Common in long grass, crops, and low bushes in the vicinity of water.

Francolinus pondicerianus interpositus (Hart.). The Northern Grey Partridge.

Abundant. On November 5, 1924, I came across a family party in which there were four or five young birds. I shot the cock and also two juv. ♂♂, one of which was preserved. These birds must have been about a month old. Another family party seen on December 28, 1924, but the young birds were much older than those seen on November 5, 1924. The breeding season of this Partridge must either be a long one, or the birds must bring up two broods.

[Eggs taken by Bingham. March–April.]

Family **Rallidæ.** Rails.

I did not obtain or even see a single Rail of any sort, and my repeated requests to sportsmen to bring me specimens fell on deaf ears. Had I the time and opportunity of investigating suitable places, I have no doubt I would have procured specimens.

Gallinula chloropus parvifrons (Blyth.). The Moorhen.

Quite common in the reeds at Okla and at the edges of jheels. Specimens shot at Okla could not be retrieved.

Fulica atra atra (L.). The Common Coot.

Seen in pools in open country such as at Ghari-hari-saroor.

Megalornis antigone antigone (L.). The Sarus Crane.

Common in open country such as obtains at Ghari-hari-saroor. A full-grown tame bird used to walk about the road near the Railway Dispensary at Raisina. The owner of this bird informed me that he caught it at Palwal when it was a chick and that the bird was over two years old. It was very tame and would peck at a closed door to intimate that it was meal-time!

Choriotes edwardsi (Gray). The Great Indian Bustard.

I am told that this species used to be found at Delhi some years ago. No sportsman of my acquaintance has either seen or shot this Bustard in recent years.

Chlamydotis undulata macqueeni. Macqueen's Bustard or Houbara.

A friend tells me that he once saw two or three Houbaras in the Delhi Province. He seems to be quite sure of the identity of the birds he saw, as one flew up within a few feet of him.

Burhinus œdicnemus indicus (Salv.). The Indian Stone-Curlew.

I remember shooting one of these birds some years ago on the river-bank at Kingsway. Not seen in 1924-25; but it must be stated that I could pay no attention to river-side birds.

[Eggs taken by Bingham. April-June.]

Cursorius coromandelicus (Gmel.). The Indian Courser.

Seen in bare, open country at Kingsway and also at Raisina. A specimen was brought to me for identification on February 20, 1925, but it was too badly damaged to preserve. Messrs. Marshall, Cock and Bingham together found several nests near the old contonments of Delhi at the end of March.

Lobivanellus indicus indicus (Bodd.). The Indian Red-wattled Lapwing.

Common in open country and fields near water.

Sarciophorus malabaricus (Bodd.). The Yellow-wattled Lapwing.

Not near as common as the last species. This bird is often referred to as the 'Yellow-eyed Plover.'

Himantopus himantopus himantopus (L.). The Black-winged Stilt.

A small flock of about ten birds seen on December 6, 1924. They were rather wary, but I managed to drop one as the birds passed over me. This proved to be a ♂ in the first plumage. Though I visited the place again I did not see any more Stilts. Hume states that this species breeds near the Sultanpur salt-works near Delhi, and Bingham says that when he visited the place in May and June 1875, 'the birds were breeding simply in hundreds.' It would be interesting to have details of a recent visit.

Numenius arquatus lineatus (Cuv.). The Eastern Curlew.

Specimens of Curlews are shot from time to time by sportsmen. I did not receive any, but they are probably this species.

Tringa hypoleuca (L.). The Common Sandpiper.

Very common at pools of water, borrow pits near the railway track, canals, etc.

Tringa glareola (L.). The Wood Sandpiper.

A specimen of this species was very kindly presented to me by a friend who shot it on January 2, 1925.

Tringa ochropus (L.). The Green Sandpiper.

Seen in small parties at the edges of tanks and pools in open country. Five birds shot on December 14, 1924, but only three could be recovered from the water and preserved—two ♀♀ and an unsexed bird. A ♂ was given to me on January 2, 1925. Several seen at pools by the railway lines on April 3, 1925. Rather common.

Tringa erythropus (Pall.). The Dusky or Spotted Sandpiper.

About ten birds seen on December 6, 1924, at a shallow pool. A much damaged specimen was brought to me on December 9, 1924. This species swims quite well.

Erolia temminckii (Leisl.). Temminck's Stint.

A small party seen on a tank near the Hauz Khas ruin on December 28, 1924. Three birds shot were far too badly damaged to skin.

Gallinago gallinago gallinago (L.). The Common Fantail Snipe.

Quite common in suitable country.

Lymnocryptes minimus (Brunn.). The Jack Snipe.

Also very common at the edges of jheels, etc.

Rostratula benghalensis benghalensis (L.). The Painted Snipe.

This 'aberrant Sandpiper' as Mr. F. Finn calls the bird, is not uncommon in suitable ground.

Hydrochelidon leucopareia indica (Steph.). The Whiskered Tern.

One solitary specimen was seen flying up and down a small pool near the Hauz Khas ruin on December 28, 1924. The bird would occasionally settle on a spit of muddy land along with several *Sterna seena* and *melanogaster*. The short, barely forked tail attracted my attention, and the bird was very kindly shot for me by a friend. Mr. H. Whistler has been good enough to identify this specimen.

Sterna seena (Sykes). The Indian River-Tern.

Very common on the riverside and the canal at Kingsway, and in any place where there is sufficient water.

Sterna melanogaster (Temm.). The Black-bellied Tern.

Not quite as common as the last. Generally found along with *Sterna seena*. Two or three pairs are always to be seen at the canal near Shah Alam's Tomb at Kingsway.

Rhynchops albicollis (Swains.). The Indian Skimmer.

Seen occasionally on the river.

Pelecanus *sp.* Pelican.

I have myself never seen any Pelicans in the Delhi Province ; but Mr. C. H. Rees tells me that he saw a party of about five Pelicans on the riverside near Jagatpur. He is unable to furnish a sufficiently detailed description and I cannot even hazard a guess as to the species.

Phalacrocorax javanicus (Horsf.). The Little Cormorant.

I saw a very large flock, consisting of 200 birds or more, flying along the Jumna at the back of the Secretariat in the winter of 1921–22. Common where there is enough water.

Anhinga melanogaster (Penn.). The Indian Darter or Snake-Bird.

Single birds are usually seen in suitable stretches of water enclosed by reeds. Generally to be seen at Okla.

Inocotis papillosus papillosus (Temm.). The Indian Black Ibis.

A party of about half a dozen seen feeding in fields off the Kutb road on December 29, 1924, but they were rather wary and I did not get specimens. Blewitt took a nest at Delhi towards the end of March. Bingham says :—'I have found only one nest of this, and that was placed in a large peepul tree in the village of Okla, a few miles from Delhi. On May 7, the nest which was a large firm platform of sticks having a shallow depression lined very thinly with grass, contained two eggs.'

Platalea leucorodia major (Temm. and Schleg.). The Indian Spoonbill.

Not uncommon. I saw a single bird near the canal at Kingsway three winters ago. A friend gave me the head of an adult bird shot on March 23, 1925. Unfortunately I was too late to rescue the entire skin ! I am told that this specimen measured about 4ft. 6 in. in expanse. The colour of the gular patch nearest the base of the bill was dull green.

Dissoura episcopa episcopa (Bodd.). The Indian White-necked Stork.

A pair seen on December 6, 1924. A small party seen on February 7, 1925, and an ad. ♂ obtained. I ate this bird as an experiment to discover its value as an edible quantity. This species, as is well known, is called the 'Beefsteak Bird', because steaks from its breast are supposed to be a good substitute for the genuine article. I did not find the flesh anything like beef, and in my opinion, it was hardly worth eating. It may be that I was unfortunate in getting a bird which did not taste nice ! This Stork is frequently seen soaring in small flocks high in the air after the manner of Vultures. The principal haunts appear to be fallow land in the vicinity of water. Several pairs may be seen on either side of the railway track. Rather a wary species.

Xenorhynchus asiaticus asiaticus (Lath.). The Black-necked Stork.

Seen commonly on the riverside, open canals, etc., singly or in pairs. Hume mentions a very large nest he found near Badli.

Ardea cinerea cinerea (L.). The Common Grey Heron.

A solitary specimen was generally to be seen near Shah Alam's Tomb at Kingsway. Several seen on Aprial 3, 1925, on the way to Ambala on either side of the railway lines.

[Eggs taken by Bingham at Burari village near Delhi at the end of March.]

Egretta *spp.* Egrets.

Seen at Kingsway, where a small party would roost among the babool trees on the banks of the canal. Numbers may be seen at the edges of the Horseshoe Jheel and other stretches of water especially those with grassy margins. No specimens were secured and the exact species is not known : probably all three White Egrets are found in Delhi.

Egretta intermedia intermedia (Wag.). The Indian Smaller Egret.

[Eggs taken by Bingham. July-August]

Bubulcus ibis coromandus. (Bodd.) The Cattle-Egret.

[Eggs taken by Bingham. July-September.]

Ardeola grayii (Sykes).

Common enough where there is sufficient water, though a couple of birds were seen on a grassy plot opposite my residence far from water and in the midst of human habitation.

[Eggs taken by Bingham. July-September.]

Butorides striatus javanicus (Horsf.). The Indian Little Green Heron.

Hume mentions a nest containing three fresh eggs he found in a clump of reed and rush outside the Western Jumna Canal a few miles from Panipat, on July 21. I did not meet with this pretty Heron.

Nycticorax nycticorax nycticorax (L.). The Night-Heron.

Seen at Kingsway. Not infrequently heard passing over at night, but unfortunately I have no record of dates.

Sarcidiornis melanota (Penn.). The Nukhta or Comb-Duck.

Not uncommon.

Anser anser (L.). The Grey Lag Goose.

Quite common in suitable country. Flocks pass over certain localities at fixed times of the day.

Anser indicus (Lath.). The Bar-headed Goose.

Also common. This Goose is often seen on small Jheels and village pools whereas *A. anser* prefers larger stretches of water.

Dendrocygna javanica (Horsf.). The Lesser or Common Whistling Teal.

Bingham found a nest near Delhi in a hollow of a decayed branch of a tree on August 9.

Casarca ferruginea (Pall.). The Ruddy Sheldrake or Brahminy Duck.

Seen commonly, singly or in pairs, on the banks of the River Jumna.

Anas platyrhyncha platyrhyncha (L.). The Mallard.

Common in suitable jheels.

Anas pæcilorhyncha pæcilorhyncha (Forst.). The Indian Spotbill or Grey Duck.

Like the last, common in suitable jheels. I understand that birds have been shot in winter in complete moult and quite unable to fly. When in this condition, the birds hide closely in the reeds and are difficult to get at.

Chaulelasmus streperus (L.). The Gadwall.

This is a very common Duck in Delhi.

Mareca penelope (L.). The Wigeon.

Not uncommon. Four years ago I saw a fine ♂ which had been shot near the waterworks at Kingsway.

Nettion crecca crecca (L.). The Common Teal.

Quite common. A stray ♂ shot on a small roadside tank on December 14, 1924.

Dafila acuta (L.) The Pintail.

Common. Large numbers are netted and brought round for sale.

Spatula clypeata (L.). The Shoveller.

Quite a common species.

Netta rufina (Pall.). The Red-crested Pochard.

Not uncommon. A few stray birds are met with, though in some years quite a number may be seen.

Nyroca ferina ferina (L.). The Pochard or Dun-Bird.

Common.

Nyroca rufa rufa (L.). The White-eyed Pochard or White-eye.

Common. A ♀ was brought to me for identification in the winter of 1921–22. This bird had been shot by an Indian shikari on the riverside near the Secretariat in Old Delhi.

Nyroca fuligula (L.). The Tufted Pochard.

I believe this Pochard is not uncommon, but I have not shot it.

Mergus albellus (L.) The Smew.

I am told that a specimen of this species was shot a couple of years ago in Dlehi. but I did not see the bird. My informant seems to be quite sure that the bird was a Smew.

ERRATUM

Hirundo daurica striolata. (Cf. vol. xxxi, p. 271.)

This is a very coarsely marked swallow on the underparts, but there are others equally coarsely marked in the British Museum from the Himalayas. It is much too small however for *striolata* and I consider it to be *H. d. nepalensis* which varies much in striation. (C.B.Ticehurst.)

NOTES ON SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA

BY

MAJOR-GENERAL H. C. TYTLER, C.B., C.M.G., C.I.E., D.S.O., F.E.S.

PART II

(*With one coloured plate and two black and white plates.*)

Continued from page 260 of this volume.

54. *Amathusia phidippus binghami*, Fruhst.

Several specimens were taken by Mr. G. Cooper in Mergui.

Amathusia p. binghami is from the Malay Peninsula and has not hitherto been recorded from within Indian limits. The only form till now known from Burma is *Amathusia phidippus fredericki*, Fruhst, from Pegu and the Karen Hills. The yellow apical and sub-marginal markings on the upperside of *A. p. fredericki* are absent in *binghami* and are replaced by paler markings of the ground colour. The underside is also somewhat different.

55. *Charaxes durnfordi merguia* sub-sp. n. Pl. V, Fig. 2, ♂.

Male : *Upperside* differs from the typical form of *Ch. durnfordi* Dist. from Sangei Ujong, Malay Peninsular, in having the basal areas of both wings much darker, as dark as in *Ch. durnfordi staudingeri*, Rothsch., from Java but of a warmer and redder brown, in *Ch. durnfordi*, Dist., the basal area is rather light ochreous brown. *Forewing*, inner row of white lunules as large as outer row as in *Ch. durnfordi*, Dist., but narrower, no white patch at the tornal angle. *Hind wing* : white terminal area rather narrower than the typical form and the inner edge even more curved than in that form, the brown discal area bordering the white marginal area powdered with violet grey forming distinct patches in interspaces 1–4, getting less distinct towards the costa.

Underside : very similar to the typical form but rather darker.

Expanse : ♂ 108 mm.

Several specimens were taken by Mr. G. Cooper in Mergui.

This race is much nearer to *Ch. durnfordi*, Dist., than to the race *Ch. durnfordi nicholi* which occurs further north in the Karen Hills.

The type is in my collection and a para type is in the British Museum.

56. *Apatura cooperi* sp. nov. Pl. II, Fig. 4, ♂

Male and female : *Upperside* both wings tawny fulvous. Forewing ; a broad blackish bar at apex of cell extending into interspaces 2 and 3, apical third blackish with two tawny spots in interspaces 2, and a small diffused blackish area near apex of interspace 1 ; pale spots from underside showing through in interspaces 3, 4 and 5 as spots paler than the fulvous ground colour. Hind wing basal and apical areas blackish, the discal band from underside showing through as a pale band and most distinct towards the costa ; a black spot in interspace 2 ; a sub-marginal row of blackish spots decreasing in size towards the dorsum followed by a blackish submarginal and terminal line. *Underside* tawny fulvous but paler than on the upperside and with no dark markings ; pale discal markings on both wings very similar to those in *Ap. sordida* M., with the exception that the white spot on the outer edge of the ocellus in interspace 2 of f.w. is missing, and the large white spot in interspace 3 is divided up into two small spots, the inner one being tinged with blue ; the discal spot below this in 2 being also tinged with blue. Female similar to male but paler and wings more rounded.

Expanse : ♂ 66 mm. ; ♀ 70 mm.

A very distinct species and nearest in style of markings to *Ap. sordida*, M. A large series was obtained in Maymyo, Northern Shan States, in September, October and November.

The types are in my collection and para types are in the British Museum.

57. *Apatura ulupi kalaurica* sub-sp. nov. Pl. II, Fig. 9, ♂

This race of *Ap. ulupi* is between *Ap. ulupi ulupi* Doherty and *Ap. ulupi florenciæ*, Tyt. ; the yellow markings of the male on the upperside are not so extensive as the former but more so than the latter ; the base of interspace 3 has a yellow spot, not present in the other two races ; base of interspace 2 is sometimes yellow as in *Ap. ulupi ulupi* and not dusky as in *florenciæ* ; black ocellus in interspace 2 of hindwing larger in *Ap. ulupi florenciæ* it is small and without the white dot. Underside very like *florenciæ* but with base of interspace 3 of forewing yellow and not dusky and the black ocellus in interspace 2 is usually white centred, in the other two races the white centre is usually wanting. Hindwing : the tornal ocellus is larger than in the other two races.

Female : very like *Ap. ulupi florenciæ* ♀ f. *albina* Tyt. with all the markings white. On the upperside it differs in having the base of interspace 3 of forewing filled with white, on the hind wing the submarginal white spots are very small and clearly defined and not large and diffused as in *albina*s Underside as in *albina*, except that the base of interspace 3 of forewing is white as on the upperside and the discal line on the hindwing is straight and not curved.

Expanse : ♂ 68 mm. ; ♀ 70 mm.

The type male was taken at Kalam, Southern Shan States, at 5,000 ft. and several males and females were taken near Maymyo, Northern Shan States, at 3,800 ft. in October.

The types are in my collection and para types are in the British Museum.

The following is the distribution of the collective species according to our present knowledge.

Ap. ulupi ulupi, Doh. Upper Assam ; Abor Hills ;
Ap. ulupi florenciæ, Tyt. Naga Hills.
Ap. ulupi kalaurica, Tyt. Northern and Southern Shan States.

58. *Adolias intermedia merguia* sub-sp. nov.

Male. Very like *A. dirtea judeitina* Fruhst., but can be at once distinguished from that form by the antennæ being entirely black and not red tipped. It differs from *A. intermedia* Tyt. in having the terminal margin on both wings broader. Several specimens were received from Mergui.

The ♂ type is in my collection.

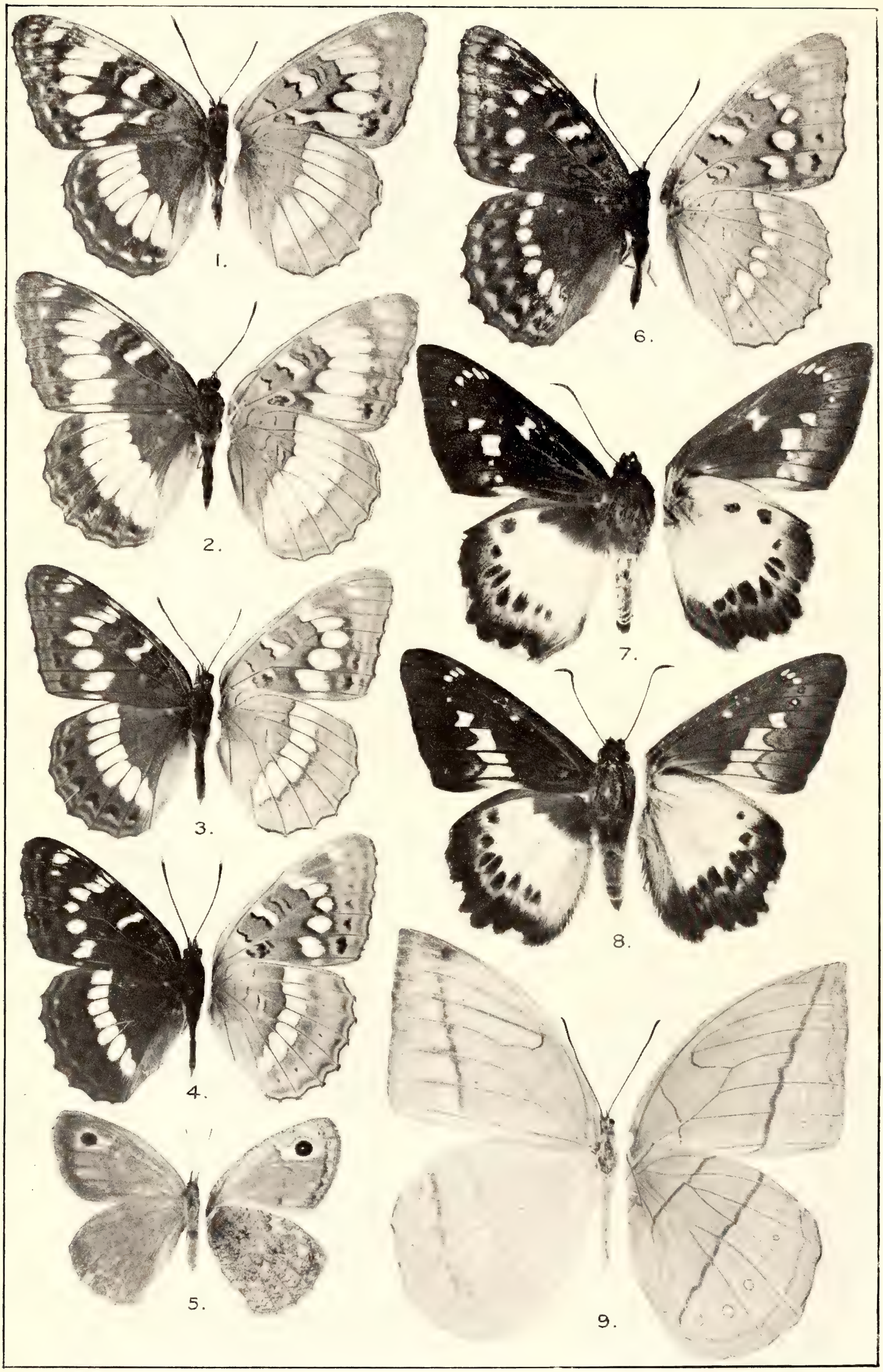
59. *Dophla cooperi* sp. nov. Pl. V, Fig. 1, ♂

Very near to *Dophla iva* M. but differs as follows :—

Male and female. *Upperside*, a brighter and lighter green with all black markings broader and darker ; the white spot of the discal band in interspace 2 of *forewing* oval in shape and smaller than spot in interspace 3 ; in *D. iva* this spot is rectangular and much larger than spot in interspace 3 ; *hind wing*, a conjoined diffuse whitish spot in interspaces 6 and 7 and not as in *D. iva* which has 2 or 3 small separate and clearly defined white spots in interspaces 5–7. *Underside*, basal area of both wings greyish green, outer half blackish green ; all black markings broad and conspicuous ; *hind wing* with a conjoined diffuse spot in interspaces 6 and 7 as on upperside and not a row of 5 or 6 small clear separate spots in interspaces 2–7 as in *D. iva*.

Expanse : ♂ 108 mm. ; ♀ 124 mm.

The types a ♂ and ♀ were taken at Anisakan near Maymyo and at Maymyo itself in the Northern Shan States respectively ; the ♂ type is in the British Museum and the ♀ type taken in October is in my collection. Another ♂ was seen in September at Maymyo but I failed to net it.



SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA.

SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA

Explanation of Plate III

Fig. 1. *Liminitis trivena pallida*, ♂, sub-sp. n.
,, 2. ,, ,, *trivena*, Moore, ♂.
,, 3. ,, ,, *ligyes*, Hewit, ♂.
,, 4. ,, *lepichini hydaspes*, Moore, ♂.
,, 5. *Maniola pulchra astorica*, ♀, sub-sp. n.
,, 6. *Liminitis lepichini gilgitica*, ♂, sub-sp. n.
,, 7. *Satarupa splendens*, *Tytler*, ♂.
,, 8. ,, *zulla*, *Tytler*, ♂.
,, 9. *Aemona lena haynei*, ♂, sub-sp. n.

Since writing the above Mr. G. Cooper has taken several males and females at Maymyo in September 1925. Some of his specimens have small black dot in interspaces 4, 5 and 6.

60. *Liminitis trivena* M. Pl. III, Fig. 2°.

The several races or species closely connected to *L. trivena* M. have been placed by various authors under the names of *trivena* M., *ligyes* Henit, and *hydaspes* M., but there has been considerable confusion and doubt as to which forms these names correctly apply ; moreover there are more than three forms and two of these will require new names. The forms flying at the extreme limits of its range, e.g. Turkistan and Garhwal, are very different looking insects, but whether they are distinct species or races of one species it is difficult to say.

Commencing from the extreme north-west the following forms occur :—

61. *L. lepichini* Ersch.

This form from Turkistan has the white spots small and macular and a conspicuous double row or red spots divided by black spots on the margin of both wings in both sexes.

62. *L. lepichini gilgitica*, Tyt. sub-sp. n. Pl. III, Fig. 6, ♂

This form occurs in Chitral, Gitgit, Astor, Chilas, Kargan Valley, Hazara and the Kishenganga Valley, Kashmir, on the Chilas Road from which place I have received a solitary specimen. It is very close to *L. lepichini* Ersch., but the red spots are smaller and darker. A single male was taken in the Liddar Valley, Kashmir, which may belong to this form but has the white spots much broader and almost as broad as in *L. ligyes* Hewit and broader than in *L. hydaspes* M. which is the local form flying in the Liddar Valley. Some of the forms in Chitral are very close to the next form *L. hydaspes* M.

63. *L. lepichini hydaspes* M. Pl. III, Fig. 4, ♂

This form occurs in Gurais and in the Scinde and Liddar Valleys, Kashmir, where it is common. Typically it differs from *L. lepichini gilgitica* Mihi in the red spots on both wings being much smaller and inconspicuous in the male and the inner row being obsolescent ; the white discal spots are macular as in *gilgitica* but rather larger, being 3 mm. wide against 2 mm. The female has the double row of red spots large and conspicuous as in *gilgitica.*

64. *L. trivena ligyes*, Hewit. Pl. III, Fig. 3, ♂

This form occurs in the Pir Panjal Range of Mountains, south of the Kashmir Valley ; it is between *L. hydaspes* and *L. trivena* M. in the width of the discal bands which are 4 mm. in width, and the discal bands are continuous and not macular as in *L. hydaspes*. The male has only one outer row of reddish spots ; the female has two rows of reddish spots but not so large and conspicuous as in *L. hydaspes* M.

65. *L. trivena trivena* N. Pl. III, Fig. 2, ♂

This form which occurs in Murree and adjoining country I take to be typical *L. trivena* M. as it agrees with Moore's original description and has ochreous red spots on the outer edge of the marginal black spots. The female often has an inner row of similar spots on the hind wing. The discal bands are 7 mm. in width.

66. *L. trivena pallida* sub-sp. n. Pl. III, Fig. 1, ♂

The form occurring in Simla differs from *L. trivena* M. from Murree as follows :—

The white bands on the upperside are as wide as in *trivena* M. but there is always a distinct white spot at the base of interspace 1 of the forewing (very seldom present in *trivena* M.) which is very often joined to the discal spot in that interspace, which it never does in *trivena* M.; the marginal black spots are bordered outwardly by *ochreous white* spots instead of by *ochreous red* spots as in *trivena* M. On the underside the ground colour is uniformly yellow and has not any orange in the cell of the forewing or on the marginal area of both wings as in *L. trivena* M.

For convenience sake I have placed those forms which have the discal band on the hind wing composed of small macular spots as races of *L. lepichini* Ersch. and those forms which have this band of broad spots forming a continuous band as races of *L. trivena* M., as this division appears to form two natural groups; but it is quite possible that all the forms are conspecific as treated by Stichel in Seitz's *Macrolepidoptera of the World*, vol. i.

67. *Neptis mackwoodi*, sp. nov. Pl. II, Fig. 1, ♂

Upperside: very like *N. ananta ochracea* Ev., but the yellow markings are somewhat different. Forewing with only two small apical spots instead of three or four large spots as in *N. ananta*. Hind wing; a narrow suffused sub-basal yellow band placed nearer to the base than in *N. ananta*, a rather broad suffused yellow band, twice as broad as the sub-basal band, placed rather less than midway between the sub-basal band and the termen not reaching the costa, in *N. ananta* this band is narrower than the sub-basal band and nearer to the termen than to the sub-basal band. *Underside* forewing very similar to *N. ananta ochracea* Ev. but the apical spots reduced to one. Hind wing differs from *N. ananta ochracea* Ev. in the sub-basal band being nearer to the base as on upperside and in being very narrow and short only reaching to v. 6, followed closely by violet bands, as in *N. ananta ochracea* Ev. but nearer the base and the ground colour between these two bands suffused with violet giving the appearance of one broad violet band with small diffused reddish patches.

Expanse: ♂ 57 mm.

Habitat: Karen Hills.

Described from a single male taken in April. Its nearest ally is *N. ananta* M. and the group which has only one streak at the base of the costa on underside of hind wing.

68. *Neptis suffusa* sp. n. Pl. II, Fig. 2, ♂

Male. *Upperside* very similar to *N. ananta* but yellow spots in interspaces 2 and 5 of forewing larger and more conspicuous.

Underside: violet marking all lighter.

Forewing: sub-apical spots larger and spot in interspace 2 also larger than in *N. ananta*; a violet speck at the end of the cell not shown in the figure and a row of three similar specks midway between this and the sub-apical spots.

Hind wing: basal area washed with pale violet almost as far as the discal band which is much wider than in *N. ananta*; post discal violet bands wider and more distinct, the sub-marginal band being distinctly double and paler anteriorly.

Expanse: ♂ 57 mm.

Habitat: A single male was taken in the Bhamo Hills.

69. *Neptis zaida* Doubleday.

Type ♂ from Mussoorie is in the British Museum. There are two forms in Mussoorie:—

(*a*) Upperside with all markings pale yellow as in the type.

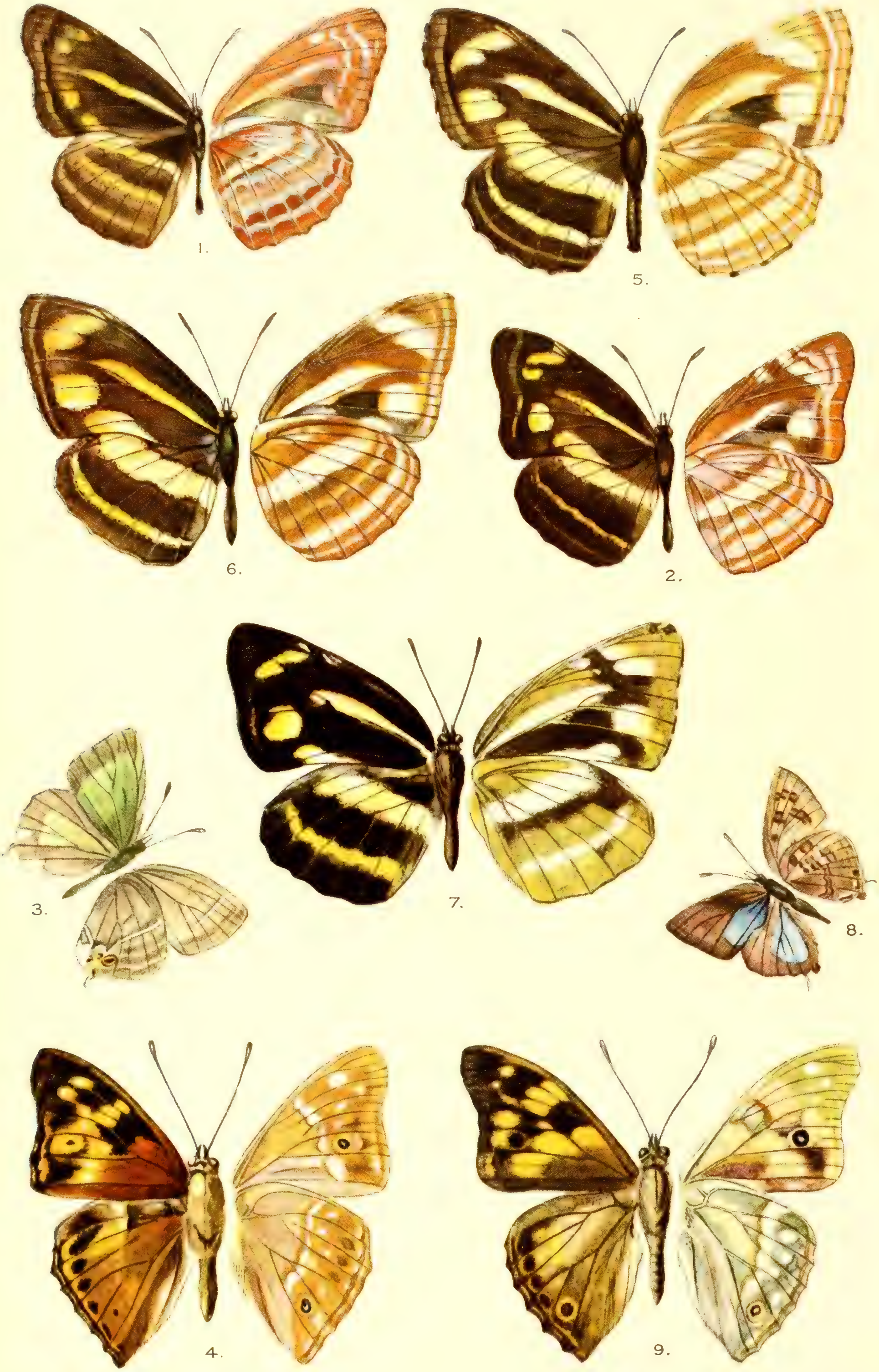
(*b*) Upperside with all markings almost pure white, ***pallida*** forma nov.

Three other closely allied forms occur within the Indian region:—

Neptis zaida bhutanica sub-sp. nov. from Sikkim and Bhutan.
Neptis zaida manipuriensis sub-sp. nov. from Manipur.
Neptis zaida drummondi sub-sp. nov. from S. Shan States.

70. *Neptis zaida bhutanica* sub-sp. nov. Pl. II, Fig. 5, ♂

Upperside: very like the typical form but the discal band on the hind wing is paler than the other markings and inclined to be whitish. *Underside:* ground colour yellowish brown and darker with all pale markings more distinct.



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SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA.

SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA

EXPLANATION OF PLATE II

Fig. 1. *Neptis mackwoodi*, ♂, sp. n.
,, 2. *Neptis suffusa*, ♂, sp. n.
,, 3. *Thecla doni*, Tytler, ♂.
,, 4. *Apatura cooperi*, ♂, sp. n.
,, 5. *Neptis zaida bhutanica*, ♂, sub-sp. n.
,, 6. ,, ,, *manipuriensis*, ♂, sub-sp. n.
,, 7. ,, ,, *drummondi*, ♂, sub-sp. n.
,, 8. *Virachola smilis smilis*, Hewit, ♂.
,, 9. *Apatura ulupi kalaurica*, ♂, sub-sp. n.

The type is from Darjeeling and there are specimens in the British Museum from that locality and from Bhutan.

Expanse : ♂ 68 mm.

The ♂ type is in my collection and para types of both sexes are in the British Museum.

71. *Neptis zaida manipuriensis* sub-sp. nov. Pl. II, Fig. 6, ♂

Male. *Upperside* : as in the typical form but all pale markings deep orange yellow. *Underside :* as in *N. zaida bhutanica* Mihi but much darker and reddish brown with all pale markings darker (not pure white) and tinged with pale yellowish brown on the forewing and with violet brown on the hind wing.

The markings on the *Underside* are nearer to *N. zaida bhutanica* Mihi than to *N. zaida zaida* Doubleday.

Expanse : ♂ 68 mm.

Three males were taken on the Lengba River, Manipur, in April.

The male type is in my collection and a para type is in the British Museum.

72. *Neptis zaida drummondi* sub-sp. nov. Pl. II, Fig. 7, ♂

Male. *Upperside :* as in typical form but darker but not nearly so dark as in *N. zaida manipuriensis* Mihi. *Underside :* as in typical form from Mussoorie but darker.

Expanse : ♂, 68 mm.

Several specimens were taken by Captain Drummond at Loimwe, Southern Shan States ; in April at about 4,500′.

The male type is in my collection.

73. *Melitœa saxitalis lunulata* Stdgr.

A single female which agrees with specimens of *lunulata* Stdgr. from Issykkul and Tashkent in the British Museum was taken in Misgar, Hunza in August. This species has not previously been recorded from within Indian limits.

74. *Melitaea balba balbina* sub-sp. n.

Smaller than *M. balba* Ev. and much paler on both sides.

Several specimens of both sexes were taken on the Shandur Pass between Gilgit and Chitral at 12,200′ in July. I have *M. balba* Ev. from Chitral taken at 11,000′ and there are specimens in the British Museum ; these specimens are very constant in markings and do not intergrade with *balbina*. The two forms may be races flying at different altitudes.

The types are in my collection and paratypes are in the British Museum.

75. *Lycœna florenciœ*, sp. n. Pl. I, Fig. 4

This very beautiful and distinct form appears to be allied to *Ly. isaurica*, Stdgr. from Syria, but the wings above are of a brighter shining blue without a grey wash : below all the markings are similar but the spots on the hind wing are larger and brighter, the red marginal spots being very conspicuous.

Expanse : ♂ 30 mm.

Two males were taken by Lieut.-Colonel Lorimer on the Baroghil Pass at the extreme north-east corner of Chitral.

The type is in my collection.

76. *Lycœna baroghila*, sp. n. Pl. I, Fig. 1, ♀

Male. *Upperside* both wings ashy brown with no markings. *Underside* very similar to *Ly. loewii sanoga* Evans.

Female. *Upperside* very like the male, but both wings have a sprinkling of blue scales in the basal area and the hind wing has a row of dark spots edged with bluish grey on the terminal margin.

Expanse : ♂ 33 mm., ♀ 35 mm.

A male and female were taken on the Baroghil Pass, North-East Chitral, in July by Lieut.-Colonel Lorimer.

The types are in my collection.

77. *Lycæna christophi lesliei* sub-sp. nov. Pl. I, Fig. 2, ♂

Ly. samudra M. was described from specimens from Skardo and the types are in the British Museum ; there are also specimens from Hunza, Ladak and Kiris.

Four males and two females from Chitral in the British Museum are very distinct and appear to be a well marked race of *Ly. chrystophi* of which hitherto *Ly. samudra* has been the only representative recorded from within Indian limits. On the upperside there is hardly any difference but on the underside *all* the black discal spots on the f.w. are much larger and strikingly conspicuous.

The types are in the British Museum and originally came out of the collection of G. A. Leslie and W. H. Evans.

Specimens from Gilgit are midway between typical *samudra* M. and *lesliei* Mihi, specimens received from Ladak are typical *samudra*.

♀♀ in the British Museum from Kiris on the upperside have much more blue than the ♀♀ of *samudra* from Skardo and ♀♀ of *lesliei* from Chitral and are probably a distinct race.

A single ♀ from Hunza is very similar to the ♀♀ of the Kiris form and may possibly be the same race but there is not sufficient material to say for certain.

78. *Lycæna astorica.* sp. nov. Pl. I, Fig. 3, ♀

Male and female. Upper and undersides alike. *Upperside :* brown with a black streak at the end of the cell of forewing.

Underside : very similar to *Ly. iris ashretha* Ev., but the f.w. is tinged with brown, in some specimens from Gilgit yellowish brown ; the discal spots on *f.w.* are evenly curved and the spots in 2 and 3 are not inwardly thrown out of line as in *ashretha* ; on the *h.w.* the black spots in 5, 6 and 7 are in line and sloping back towards the base at a greater angle than the same spots do in *ashretha.*

Expanse : ♂ 31 mm.; ♀ 32 mm.

The ♂ type is from Gudhai in Astor and the ♀ type from Haitar nala in Gilgit. Many of the specimens from Gilgit are larger than the Astor forms. The types are in my collection and para types are in the British Museum.

79. *Lycæna metallica,* de N.

The type is from Lahoul.

There are specimens in the British Museum from Kulu, Kokser and the Baralacha Pass, north of Lahoul leading into Rupshu which are typical.

Ly. metallica, deN is an insect with a broad black border to both wings 4 mm. wide and with the basal two-thirds blue tinged with green.

Specimens of females in the British Mesuem are completely brown with no blue at the base.

80. *Lycæna metallica chitralensis* sub-sp. nov. Pl. I, Fig. 6, ♂

This very distinct form of which there is a good series in the British Museum taken by Maj. Wall in Chitral, probably in Southern Chitral as specimens from the Shandur Pass in North-East Chitral belong to the race below *L. metallica gilgitica* Mihi, differs from *metallica* de N. as follows:— The black border is only 2·5 mm. in width and the blue is a bright purplish blue with no greenish tinge.

The females are sometimes completely brown above and sometimes have little blue at the base ; one ♀ has indications of red spots.

81. *Lycæna metallica gilgitica* sub-sp. nov. Pl. I, Fig. 7, ♂

This form of *metallica* is very like *Ly. metallica chitralensis* in the width of the black border but the blue is of a different shade being purplish and darker and not so bright and is nearer to the form *Ly. metallica chrysopis* Gr. Gr., which occurs in the Hindu Kush Mountains and in the Pamirs, except that *chrysopis* has a very narrow black border to both wings the width being only 1·5 to 2 mm., in *gilgitica* it is 2·5 mm. The females are completely brown.

Habitat. Shandur and Baroghil Passes in Chitral ; Gilgit (Type) ; Astor.

82. *Lycaena galathea chitralica* Ev.

Several typical males were taken in Chilas one *male* looks rather like a *female* form and has the blue on upperside rather restricted and with faint red spots on the terminal margin of the hind wings. Mr. Tams of the British Museum kindly examined the specimen for me under a microscope and it proved to be a *male*.

83. *Lycæna galathea depreei* sub-sp. nov. Pl. I, Fig. 5, ♂

Several males taken by Colonel Depree in Dras differ from typical *galathea* in their smaller size and darker blue colouration on the upper side of the male and in the darker grey area on the *under* forewing. The black border is usually narrow but in some specimens it is broad ; in one male it is 3 mm. in width.

Expanse : ♂ 30 mm.

84. *Lycæne orbitulus jaloka* M.

Mr. de Nicéville correctly described the three forms that were then known and gave their geographical distribution, but since then various authors have rather confused matters by placing *Ly. ellisi* Marshall as a synonym of *leela* de N. and by mixing up the localities from which the various geographical forms come.

The ♂ type of *L. jaloka*, M., a worn specimen, is in the British Museum and is labelled Kashmir ; the distribution of *jaloka* is given as Rajdiangan Pass, Sursungun and Stackpida Passes, Baitul, but the exact locality where the ♂ type was taken is not given.

On the *underside* of the ♂ type f.w. there are traces of obsolescent black spots within the white spots ; on the hind wing the basal dark area contains only one *distinct* white spot at the end of the cell, the *discal row* and *costal white* spots are hardly visible and are merged into the marginal pale area. de Nicéville mentions this point as distinguishing *jaloka* from *leela* and *ellisi*. In both the latter sub-species, these white spots are conspicuous, and the costal ones enter the dark basal area.

In specimens from the Liddar Valley the forewing on the underside is almost white and devoid of all markings.

85. *Lycæna orbitulus ellisi* Marsh.

This is a very distinct form from the Sanch Pass Panji and there are specimens in the British Museum from that locality and from Dugi and Kukti (presumably in Pangi), the specimen from the latter two localities only differ from the one from the Sanch Pass in their slightly larger size. On the upperside the spots are pure white and not bluish white as in *jaloka* and the white spot at the end of the cell on upperside of the forewing bears scarcely any trace of black ; in *jaloka* this spot is distinctly black and narrowly white edged. On the *underside* all the spot are white and well marked and the basal area of the hind wing is very similar to that of *jaloka*, the white spots only being more conspicuous.

Swinhoe's figure of the second form of ♂ *ellisi* of which the original specimen is in the British Museum agrees exactly with the figure of de Nicéville's *leela* except that the spot at the end of cell in de Nicéville's figure on the *underside* of the forewing is shown as pure white but this is probably an error as in de Nicéville's description he distinctly says, ' *all the spots are black centred* '.

There is no doubt in my mind that this second form of *ellisi* is nothing but de Nicéville's *leela*.

86. *Lycæna orbitulus astorica* sub-sp. nov. Pl. I, Fig. 8

Three males and a female were taken in the Rupal Valley, Astor, which differ from typical *Ly. orbitulus leela* in the absence of the pale spots on the upperside of the male and in the pale spots in the female being small and rather indistinct.

A pair were also taken by Major Stockley on the Stacksby Pass, Gurais.

The types are in my collection.

87. *Lycæna orbitulus leela* de N.

The type ♀ was taken on the Dras side of the Zogi La Pass and ♀♀ were taken on the Manika Pass, Ladak and Fotu La, Ladak.

On the *upperside* the pale bluish spot at the end of the cell forewing is black centred, in *ellisi* it is practically white with the black centre reduced to a point. On the *underside* the white spots on the forewing are conspicuously black centred and on the hind wing the basal area is dark yellowish brown with a large discal white spot and two distinct white costal spots entering this area ; the discal row of white spots are distinct and sometimes are outwardly defined by yellowish brown.

The following appears to be the geographical distribution of the various forms :—

Ly. orbitulus walli, Evans.	... Gilgit, Chitral.
Ly. orbitulus astorica, Tyt.	.. Astor, Gurais.
Ly. orbitulus leela, deN. ...	... Deosai, Dras and Ladak.
Ly. orbitulus jaloka, M. ...	... Kashmir, Tragbal, Scinde Valley, Liddar Valley, Baitul.
Ly. orbitulus ellisi, Marsh.	... Pangi.

88. *Polyommatus sarta rupala* sub-sp. nov. Pl. I, Fig. 14, ♂ ; 15, ♀

Male : *Upperside* : vary similar to *P. sarta sartoides* Swinhoe but the blue is not so extensive and is more powdery in appearance both wings have a dark marginal area 3 mm. in width and much wider than is *sartoides* Sw. Underside similar to *sartoides* Sw.

Female : differs from typical *sartoides* ♀ in red spots on h.w. not being so conspicuous and in the f.w. all red spots being obsolescent, sometimes those in 1 and 2 being faintly visible.

Expanse : ♂ 54 mm. ; ♀ 56 mm.

Habitat : Rupal Valley, Astor, where a fairly good series was taken in July and August.

89. *Polyommatus sarta gooraisica* sub-sp. n.

Three males and four females from Gurais in the British Museum which were mixed up with specimens of *P. devanica* M. appear to be a *sarta* form. The chief difference according to Col. W. H. Evans between *devanica* and *sarta* forms is the position of the spots on the underside of the hind wing in interspaces 5, 6 and 7. In *devanica* forms the spot in 6 is as a rule nearer to spot in 7 than to the spot in 5 and is placed inwardly to a straight line between the two outer spots, whereas in *sarta* forms the middle spot in 6 is about half-way and is outwardly placed to a straight line between the two outer spots, thus :—

devanica forms	*sarta* forms
6°	7°
7°	6°
5°	5°

The specimens above referred to are different to any other *sarta* forms I have seen and appear to be a good race of that species.

On the upperside of both wings the blue is much more restricted than in the form *P. sarta rupala* Mihi.

Expanse : ♂ 32 mm. ; ♀ 34 mm.

Habitat : Gurais.

The types are in the British Museum.

90. *Polyommatus gigantea gilgitica* sub-sp. n. Pl. I, Fig. 16, ♂

The race of *P. gigantea* Gr. Gr. from Gilgit differs from the typical form from the mountains of Hissar, Central Asia, in the upperside of the male being of a darker and brighter blue and not a silvery blue with the veins lighter and silvery in some lights. Underside : very similar to the typical form.

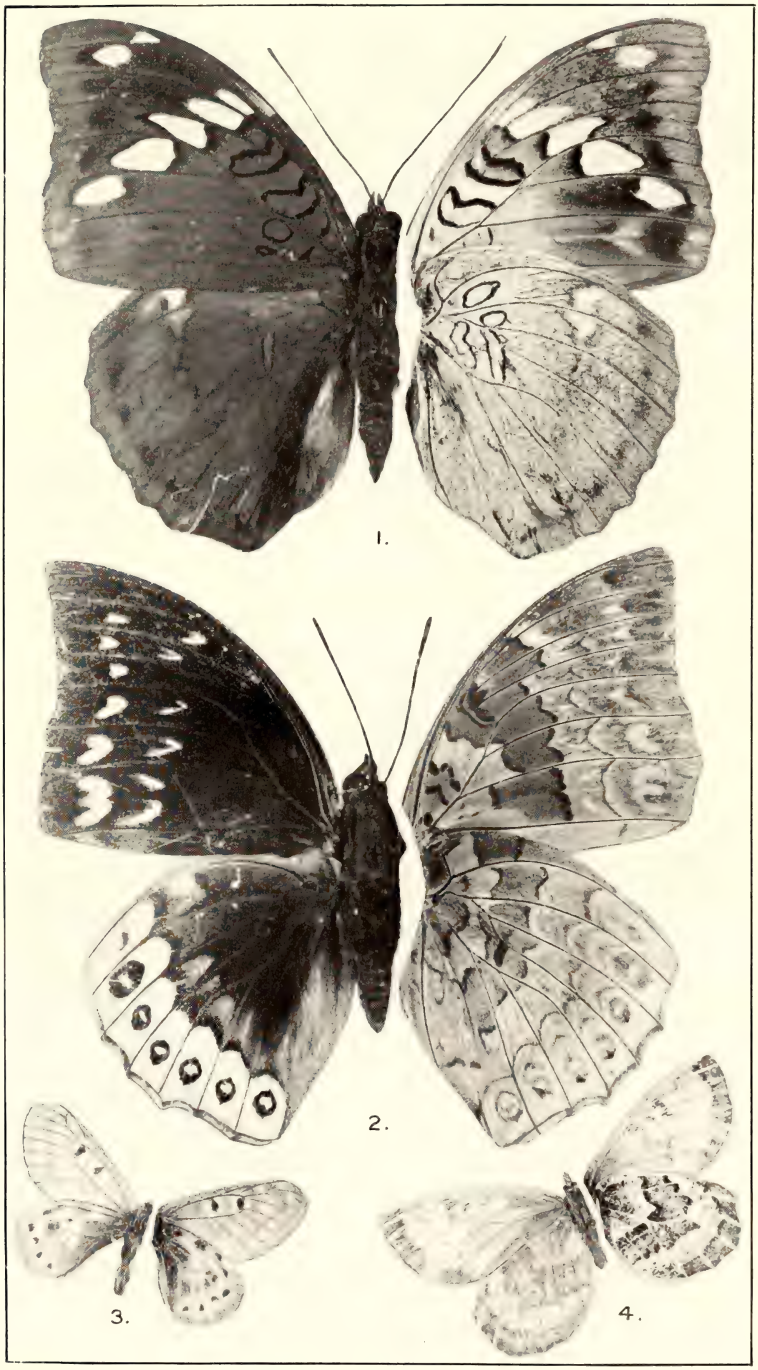
Two males were taken in Yasin, Gilgit, in July.

The form of *polyommatus* recorded by Colonel W. H. Evans in the *Journal, Bombay Natural History Society*, vol. xxx, 1925, under the name of *P. iolas* is probably the insect now described. *P. iolas* from Europe and Asia Minor is a much duller blue above than *P. gigantea* Gr. Gr. and has a blue female

SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA

EXPLANATION OF PLATE V

Fig. 1. *Dophla cooperi*, ♂, sp. n.
,, 2. *Charaxes durnfordi merguia*, ♂, sub-sp. n.
,, 3. *Parnassius acco punctata*, ♀, sub-sp. n.
,, 4. *Oeneis garhwalica*, ♀, sp. n.



SOME NEW AND INTERESTING BUTTERFLIES FROM INDIA AND BURMA.

with the costal and terminal borders heavily marked with black ; on the underside hind wing the row of discal spots is continuous and not broken in interspace 2. In *P. gigantea* Gr. Gr. the males above are bright shining blue and the female is pale brown with only a very slight dusting of blue scales towards the base of both wings ; in some specimens of an unnamed race from Ferghana these blue scales are entirely wanting. On the underside hind wing the discal row of spots is completely broken in interspace 2 by the spot in that interspace being placed markedly inwards and so completely out of line.

91. *Orthomiella putaoica* sub-sp. n., Pl. I, Fig. 20, ♂

Male ; Upperside: both wings rich brown with the costal third of the hind wing bright shining light purple, the lower edge being straight and sharply defined. Underside markings similar to *O. pontis* El., but much darker.

Expanse : 23 mm.

Three males were taken in Putao at the extreme north-east corner of Burma in March and April.

This insect appears to be closely allied to *O. rovorea* Fruhst from the Chin Hills and which I only know from the description in Seitz's *Macrolepidoptera of the World*. It differs from the description of *rovorea* in having the *anterior third* only of the hind wing bright shining light purple whereas *roverea* is described as having '*a sharply defined light violet reflection on the anterior half of the hind wing*' ; the band on the underside of forewing is quite distinct and not obsolescent as in *rovorea* and the band on the hind wing is also broad and distinct and not narrow as in *rovorea*. *O. putaoica* flies with *O. pontis* the two forms being taken together, and therefore it cannot be considered as a race of *O. pontis*.

The type is in my collection and a para type is in the British Museum.

92. *Niphanda marcia* Fawcett.

This form has been omitted by Colonel Evans in his ' List of Butterflies '.

The females are brown and very like the females of *N. cymbia* de N. but are rather smaller and darker.

On the underside the female can be distinguished from the same sex of *N. cymbia* by having a *complete* row of large black marginal spots on the hind wing ; in *N. cymbia* female in addition to the double tornal spot on the hind wing there are only *two* other spots on the margin which are black the remainder being greyish or obsolescent.

The males of *N. marcia* are according Bingham and Swinhoe are lighter in colour on the upperside but I have not seen a specimen.

Three females were caught at Sinha, S. Shan States, at 3,800′ in July. They agree with a single female in the British Museum.

93. *Niphanda tessellata*, M.

The females of this form can at once be distinguished from those of *N. cymbia* and *N. marcia* by being blue above and not brown. On the *underside* hind wing the female differs from the females of the above forms in only having *one terminal black* spot in addition to the tornal double spot, the remaining spots being greyish or obsolescent.

The distribution of the genus *Niphanda* in India appears to be

N. cymbia, de N.	Sikkim-Manipur.
N. tessellata, M.	N. Shan States, S. Shan States.
N. marcia, Fawcett.	S. Shan States, Mergui.

94. *Thecla doni*, Tytler, Pl. II, Fig. 3, ♂

I take this opportunity to figure the male type specimen of this insect which was described in the *Journal, Bombay Natural History Society*, vol. xxiv, p. 129, 1915, but which was received too late to be figured.

95. *Horsfeldia anita gigantea* sub-sp. nov.

Both the dry season and wet season forms of the race of *H. anita*, Hewit., which occurs in Manipur, are very much larger than specimens from the N. Shan States, Upper Burma and from specimens from further south which agree with the type of *H. anita* Hewit, from Perak.

On the upper side the purple colour is brighter and the black terminal border is much broader being 3 mm. against 1 mm. of typical *H. anita* Hewit.

On the underside the colour is a good deal darker.

Expanse : ♂♂ d.s.f. 54 mm. ; w.s.f. 56 mm.
♀♀ d.s.f. 58 mm. ; w.s.f. 62 mm.

15 ♂♂ and 1 ♀ of the d.s.f. were taken in the Manipur Valley and at Sebong on the borders of Burma in April and June and 5 ♂♂ and 1 ♀ of the w.s.f. were taken at the same places in July and August.

The types are in my own collection and ♂ para types of both seasonal forms in the British Museum collection.

96. *Amblypodia camdeo sebonga* sub-sp. nov.

The form of *A. camdeo* from Sebong on the Burmese border of Manipur differs considerably from the *typical* form and is between that form and *A. camdeo varro* Fruhst., from Burma.

Male. *Upperside* as in the typical form but rather darker. *Underside*, the dark spots encircled with white are much paler and *brown* and not *blackish brown* as in the typical form and which contrast so sharply with the pale ground colour of the wings ; on the *hind wing* the colour of the spots in many cases is no deeper than the ground colour of the rest wing.

In a *camdeo varro* the colour of the spots is also brown and not blackish brown but a good deal darker than the ground colour of the wings and the colour of the *upperside* of the wings is darker than in Manipur form.

Expanse : ♂ ♂ 49-53 mm.

Described from five males taken in April and June.

The type is in my collection and a paratype is in the British Museum collection.

97. *Amblypodia suffusa atarana* sub-sp. nov., Pl. I., Fig. 13, ♀

The form of *A. suffusa* Tyt. obtained by Mr. G. Cooper in the Ataran Valley, Burma, is very different from the typical form from Manipur and appears to be a well-marked race.

Female : *Upperside*, the blue colouration much bluer and vivid, very much the same as in ♀ *A. mirabella*————, and not purplish blue as in the typical form of *A. suffusa* ; the blue is also very much more extended on both wings almost reaching the termen on the hind wing.

Underside : ground colour and markings as in *A. suffusa* Tyt.

Described from a female specimen presented to me by Mr. G. Cooper who has other specimens from the same locality.

The ♀ type is in my collection.

98. *Amblypodia maymyoia* sp. nov.

Male : *Upperside* dark dull purplish blue very similar to *A. birmana* M.; a *broad* black terminal border, 2·5 mm., continued well along the costa on forewing and to base of costa on the hind wing. *Underside* markings somewhat similar to *A. aberrans*, de N., but ground colour darker and the discal band on forewing not completely disjointed as in *aberrans* but merely out of line.

Female : *Upperside* somewhat like *A. aberrans*, de N., but *much* brighter blue and with only the base of interspace 4 of forewing white. *Underside* as in the male.

Expanse : ♂ 37 mm.; ♀ 37 mm.

Two males were taken in Maymyo, Upper Burma, at 3,500′ in April and a female at Sinho, S. Shan States, at 3,800′ in July.

The types are in my collection and a ♂ paratype is in the British Museum.

99. *Virachola dohertyi*, Tytler, Pl. I, Fig. 17, ♂

I take this opportunity to figure the male type specimen of this very rare and distinct looking insect which was described in the *Journal, Bombay Natural History Society*, vol. xxiv, p. 138, 1915 and still remains unique.

100. *Virachola smilis nicévillei* sub-sp. nov.

=*V. smiles* de N., Nee Hewit.

Hewitson described his *Virachola smilis* from a ♀ specimen and gave the vague term of ' East India ' for its locality. His insect may have come from South Burma as Mr. G. Cooper has taken it there.

de Nicéville knew this insect only from Hewitson's description and figure, and on receiving a ♀ form from the Andamans considered it to be Hewitson's insect and as Hewitson's description was not very full he described the Andaman insect in greater detail and figured it in the Butterflies from India, Burma and Ceylon, vol. iii.

According to this description and figure the Andaman form is not typical and differs from *smilis* Hewit, as follows :

Underside. Forewing ; the discal band is only partially disjointed, the two portions touching one another ; in *smilis* the two portions are completely disjointed and the two portions do not touch. Hind wing : there is no spot in the middle of the cell ; in Hewitson's figure a spot is shown and in my male this spot is broken in the middle and becomes a double spot. deNicéville's insect appears to be an insular race of Hewitson's *smilis* and I propose the name of *nicévillei* for it.

101. *Virachola smilis smilis*, Hewit., Pl. II, Fig. 8, ♂

I take this opportunity to figure the male of Hewitson's insect as his figure of the female type is probably not accessible to most collectors in India.

Expanse : ♂ 38 mm. ; ♂ 46 mm. (according to Hewitson's figure).

Several males were caught by Mr. G. Cooper on Metharan Hill, S. Burma. The ♂ type is in my collection.

102. *Pseudochliarsa virgo* Elwes.

In the *Journal, Bombay Natural History Society*, vol. xxiv, p. 139, I desribed as a new species a male and two females under the name of *P. virgoids* and also recorded the capture of two insects which I considered to be *S. virgo* as they agreed with de Nicéville's description and figure of the ♂ of that inset.—Elwes' type specimen was a female. The two insects considered to be *S. virgo* however had no secondary sex marks as in the *genus sinthusa* and appeared to be females, and I expressed my doubt as to correctness of my identification and as to the insect described by de Nicéville being the true male of *S. virgo* El. or indeed a male at all and considered it possible though highly improbable that the description was taken from a female insect ; and that my *P. virgoides* might turn out to *S. virgo* El. and that de Nicéville's male and my two insects might require a new name.

On proceeding to England J compared my five insects with Elwes' ♂ type of *S. virgo* in the British Museum and found my two females *P. virgoides* agreed in all respects and were really *S. virgo.* Above the type specimen there were several other female specimens of *S. virgo* and amongst them was a male which had been overlooked. This male agreed exactly with my ♂ *P. virgoides ;* there is no doubt in my mind that these males are the true males of *S. virgo* El. and so the name of *virgoides* must sink as a synonym.

The question then arose as to the correct name of the ♂ insect described by de Nicéville and my two insects which agreed with his description and figure.

On my return to India the two insects in the de Nicéville's collection in the Calcutta Museum considered by him to be males of *S. virgo* Elwes were obtained on loan by Col. W. H. Evans and myself. On examination these insects proved to be females and an egg was extracted from one. These were the only two blue specimens in the de Nicéville collection which could be considered males, the third specimen over the label of *S. virgo* being a whitish insect and the true ♀ of Elwes' insect. If de Nicéville really described his male insect it is not in the Calcutta Museum now and until a male is discovered agreeing with his blue females it must be supposed that he wrongly described his male from a female.

In any case the two females in the Calcutta Museum and the two blue insects in my collection which also proved to be females require a new name ; but until a male is discovered agreeing with these females it may be as well to treat this form, for the present, as a ♀ variety of *virgo*, El. and I propose the name ♀ *f. confusa. nov.*

The type and para type are in my collection.

103. *Rapala rubida* n. n. *prorosacea* Tyt. n., Plate I, Fig. 18, ♂

In the *Journal*, *Bombay Natural History Society*, vol. xxiv, p. 138 of 1915 I described this species under the name of *Virachola rosacea*. The insect appears to be an aberrant form in that, in general appearance, the upperside looks likea *Rapala* but on the underside of the hind wing the style of markings is closer to a *Virachola* ; and the sex mark on the upper hind wing is also like that of a *Virachola*. The venation however is nearer to *Rapala* than to *Virachola* and it is better to consider it as *Rapala* form rather than a *Virachola*. The name of *rosascea* however is preoccupied, and was given by de Nicéville to quite a different form of *Rapala* and consequently the name of *rosacea* for this insect will have to fall and a new name substituted. I propose the name *rubida*.

104. *Satarupa splendens*, Tytler Pl. III, Fig. 7, ♂

This butterfly was described in the *Journal*, *Bombay Natural History Society*, vol. xxiv, p. 147, 1915. I take this opportunity to figure the male.

105. *Satarupa zulla* Tytler, Pl. III, Fig. 8, ♂

Two males have since been received from Sikkim taken in July and August. I take this opportunity to figure the male of this species which was described in the *Journal of the Bombay Natural History Society*, vol. xxiv, p. 148, 1915.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON

REPORT No. 43

NELLIAMPATHY PLATEAU AND PALNI HILLS

BY MRS. HELEN M. LINDSAY M.A., B.SC.

(*With Field Notes by the Collectors.*)

COLLECTION ...	No. 43.
LOCALITY ...	Nelliampathy Plateau, Palni Hills.
DATE ...	April–June, Sept.–Dec. 1921; Feby.–June, 1922.
COLLECTED BY ...	C. McCann and the late J. Riley O'Brien.

Four Reports from areas in the Madras Presidency have already been published, viz. :— No. 11 for Coorg, No. 31 for Nilgiris, No. 33 for High Wavy Mountains, and No. 34 for South Travancore. These places all lie between 8°50′ and 12°50′ N. and 75°20′ and 78° E. thus representing the western side of the Presidency. The collections described in this Report also belong to this series and supplement in some instances the earlier ones.

The area from which these collections were obtained includes that of High Wavy Mountains of Report No. 33, and stretches 76°50′ E. to 78°E. and from 10° N. to 11 N°. Three distinct centres were visited but as these altogether cover a circle of not more than eighty miles in diameter, it seemed better to deal with them as a whole, especially as the same creatures were found in each, with only a few local differences.

The natural features are thus described for the Nelliampathy Hills by Mr. O'Brien :—

'The Western Ghats are broken only once in their entire length by a gap of 'fifty miles north to south, known as the Palghat Gap. The Palghat Hills lie 'to the north of this and those to the south are called the Nelliampathy Hills, 'roughly thirty-five miles in length and five to ten miles broad. The latter show 'four distinct divisions :—

'(1) The northern slopes, rising precipitously from the plains and 'clothed in deciduous jungle, cut by occasional gullies.

'(2) Plateau country, consisting of undulating land clothed with dense 'evergreen forest, coffee cultivation and occasional patches of lemon grass and 'lantana scrub.

'(3) The higher ranges with peaks about 5,000 feet above sea level com'posed of grassy downs interspersed with evergreen sholas.

'(4) Southern slopes gradually dropping away into the Nelliampathy 'valley which are for the most part evergreen jungle, except to the east, where 'it is more deciduous.'

The country is thus a series of hills and valleys, clothed with dense evergreen jungle, in which clearings for coffee have been made. 'The coffee area is 'covered with closely planted coffee bushes interspersed with trees such as the 'silver oak, jack, etc., to provide shade for the former. The ground is carpeted 'with dead leaves making noiseless movement an impossibility.'

According to the Gazetteer, the Palni Hills are outliers of the Western Ghauts, projecting in E.N.E. direction for fifty-four miles with an average width of fifteen miles. The Kambam Valley, the region of Report No. 33, is on their eastern slopes. A large number of prehistoric dolmens or burial cairns are to be found on these hills, which are also famed for their wealth of botanical interest, as noted by Fr. Blatter in vol. xxv, p. 290 of this Journal. These hills are situated 10°–10°26′ N. and 77°14′ and 77°52′ E.—a total area of 800 sq. miles. On the south side they end in steep sheer precipices, such as the Kambam area, but on the north the slope is more gradual. They show the same grass-covered downs as the Nilgiris and Nelliampathy Hills.

Both areas are composed mainly of Archæan gneiss buried in many parts under alluvium. They are inhabited by an indigenous race of miserable jungle folk, called Karders in the Nelliampathy Plateau and Paliyans in the Palni Hills, who dwell in rocks or encamped under trees, living on vermin, roots and honey. Coffee planters and their employees are now the other members of the population.

In a letter, the late Mr. O'Brien asked us particularly to thank Mr. A. P. Kinloch of the Cotengady Estate, twenty-four miles from Palghat, for his hospitality and kind assistance. This place was the headquarters of the Survey work for the Plateau.

The localities from which specimens were obtained are :—

(1) Nelliampathy Plateau.—Cotengady Estate ; Seetagundy Estate ; Shernelly ; Karapara.

(2) Palni Hills.—Kodaikanal as centre ; Palni Town ; Udamalpet ; Perumal ; Machur ; Shambagunar ; Silver Cascade—all not more than twenty-five miles distant from Kodaikanal.

Although the Nilgiri ibex, tiger, panther, sambur, barking deer and mouse deer are known to be found in these regions, no specimen of them was obtained in these collections. Mr. O'Brien notes that they are fairly numerous, but difficult to find in these heavy jungles. No specimen of *Hipposideros* was obtained, perhaps because the collecting grounds were for the most part at altitudes over 3,000′ which Mr. Shortridge in the Coorg Report No. 11, noted as the limit for these bats. But at Perumal, near Kodaikanal, at 5,000′ a single specimen of the new sub-species, *Harpiocephalus harpia madrassius* was found. A new species of *Leggada* was also got at that place. There is still no trace of *Viverra civettina* in this region. In Report No. 34 for Travancore, Mr. Wroughton comments on the fact that not since 1862 had a specimen been collected in South India, though the original one came from Malabar.

The three collections number 349 specimens, belonging to 30 genera in 43 species, thus :—

(1) MACACA FEROX, Shaw.

The Lion-tailed Macaque.

1792. *Simia ferox*, Shaw, Mus. Leverianum, p. 69.
1889. *Macacus silenus*, Blanford, Mamm., No. 5.
Cotengady Estate, Palghat—♂ 1.

(2) MACACA RADIATA, Geoff.

The Bonnet Monkey.

(Synonymy in No. 5 under *M. sinica.*)

Shernelly, Palghat. ♂ 1, ♀ 1 ; Palni Hills, ♀ 1 ; Perumal, 5,000′, ♂ 2 ; Machur, 4,000′, ♂ 1, ♀ 1.

Mr. McCann notes that 'this monkey is fairly common, and is seen moving 'about in troops in the sholas. Early in the morning when it is cold I 'have seen the monkeys sitting together in groups of twos and threes, if I 'mistake not, to keep each other warm. They relish the fruit of the *Eleocarpus tuberculatus* and *Pygeumi gardneri*.'

(3) PITHECUS ENTELLUS ANCHISES, Blyth.

The Southern Langur.

(Synonymy in No. 5.)

Shernelly, Palghat—? 1.

(4) PITHECUS JOHNI, Fischer.

The Nilgiri Langur.

(Synonymy in No. 11.)

Palghat—Kumblacodie, ♂ 1 ; Anamaad, ♂ 1 ; Palagapandy, ♂ 1 ; juv. Cotengady Estate, ♂ 3, ♀ 2, ? 3 ; Seetagundy, ♂ 1.
Palni—Machur, 4,000′, ♀ 1 ; Kukhal, 6,100′, ♀ 1 ; Pamber River, Kodaikanal, 7,000′, ♀ 2.

'This animal is extremely shy and difficult to approach. They move about 'in troops in the dense evergreen. One specimen weighed 25 lbs. Young 'females are frequently found solitary or in pairs. The flesh of these 'monkeys is greatly prized by the natives who thus use it :—

(1) 'The blood when fresh is drunk as a medicine against any sickness.

(2) 'The flesh is hung up and dried or smoked and when required made 'into soup to be taken as medicine against asthma and coughs.

(3) 'The gall is drunk also as a remedy for sickness.' C. McC.

(5) CYNOPTERUS SPHINX, Vahl.

The Common Plantain Bat.

(Synonymy in No. 6.)

Palghat—Karapara, ♂ 1 ; Cotengady, ♂ 2, ♀ 1.

(6) RHINOLOPHUS ROUXI, Temm.

The Rufous Horse-shoe Bat.

(Synonymy in No. 5.)

Perumal, Palni—♀ 1.

(7) RHINOLOPHUS BEDDOMEI.

The Himalayan Horse-shoe Bat.

(Synonymy in No. 11.)

Shernelly, Palghat.—♂ 1.

(8) MEGADERMA SPASMA HORSFIELDI, Blyth.

The Malay Vampire Bat.

(Synonymy in No. 5 under *M. sp. trifolium*.)

Cotengady Estate, Palghat.—♂ 2.

(9) LYRODERMA LYRA, Geoff.

The Indian Vampire Bat.

(Synonymy in No. 1.)

Pundi, Palni—♂ 1, ♀ 3.

(10) PIPISTRELLUS CEYLONICUS INDICUS, Dobson.

Kelaart's Pipistrelle.

(Synonymy in No. 1 under *P. ceylonicus*.)

Palni Hill—Silver Cascade, 5,800′, ♂ 1 ; Shambaganur, 6,000′, ♀ 1 in al. 1 ; Machur, 4,000′, in al. 2.

(11) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrelle.

(Synonymy in No. 5.)

Palni Town, ♂ 2.

(12) SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

(Synonymy in No. 1.)

Seetagundy Estate, Palghat—♂ 1.

(13) HARPIOCEPHALUS HARPIA MADRASSIUS, Thos. sub-sp. Nov.

The Hairy-tailed Bat.

1923. *Harpiocephalus harpia madrassius*, Thomas, *J.B.N.H.S.*, vol. xxix, p. 88, Perumal, Palni Hills, 5,000′, ♀ 1.

'This animal I had in captivity for three or four days, fed on moths and 'other insects. It would not eat any fruit. It used its tail membrane as a sort 'of bag when it was eating, into which it buried its head, suspending itself 'with the claws or wings from the top of the cage, and using its feet for 'pushing the insect to and fro. It ate only the body of moths.' C. McC.

(14) RHINOPOMA HARDWICKEI, Gray.
The Lesser Indian Mouse-tailed Bat.
(Synonymy in No. 3.)

Palni Hills, ♀ 2.

(15) PACHYURA, sp.

Palghat—Seetagundy, ♂ 2; Cotengady, ♀ 2.
Palni Hills—♀ 1; Kodaikanal, 7,000′, ♂ 6, ♀ 2, ? 1.
Pamber River, ♂ 1, ♀ 1, Kukhal, 6,100′, ♀ 1.
Shambaganur, 6,000′, ♂ 4, ♀ 4.

(16) FELIS AFFINIS, Gray.
The Jungle Cat.
(Synonymy in No. 1.)

Perumal, 5,000′, ♀ 1.

(17) FELIS BENGALENSIS, Keer.
The Leopard Cat.
(Synonymy in No. 11.)

Silver Cascade, 5,800′, ♂ 1.

(18) PARADOXURUS JERDONI, Blanford.
The Brown Palm Civet.
(Synonymy in No. 11.)

Silver Cascade, 5,800′, ♂ 1; Tiger Shola, ♂ 1, ♀ 1; Pamber River, 7,000′, ♂ 1, and 1 skull only.

'This animal was up a tree during the day eating the fruit of *Ficus macrocarpus*, a large climber. The fruit of this fig is supposed never to be eaten by any animal, but I actually saw this animal eat the fruits although they were not ripe.' C. McC.

(19) HERPESTES EDWARDSI CARNATICUS, Wroughton.
The Common Carnatic Mongoose.
(Synonymy in No. 22.)

Palghat—Shernelly, ♂ 1.
Palni Hills—Kombu, ♂ 1; Udamalpet, ♀ 1.

(20) HERPESTES FUSCUS, Waterh.
The Nilgiri Brown Mongoose.
(Synonymy in No. 11.)

Tiger Shola, Palni Hills—♂ 2.

(21) HERPESTES VITTICOLLIS, Benn.
The Stripe-necked Mongoose.
(Synonymy in No. 11 also see No. 31.)

Shambaganur, 7,000′, ♂ 1.

(22) CANIS NARIA, Wroughton.
The Jackal.
(Synonymy in No. 1 under *C. aureus*.)

Perumal, 5,000′, ♀ 1; Kukhal, 6,100′, 1 skull only.

(23) AMBLONYX CINEREA, Illig.
The Clawless Otter.
(Synonymy in No. 11.)

Kodaikanal, 7,000′, 1 skull only.

'These animals inhabit almost all the streams round about here but are very difficult to trap. This specimen was caught in the stream not four yards from my tent, while the lamp was still burning and shining on the water. Their chief food is crabs which are plentiful in the streams, where fish are unobtainable.' C. McC.

(24) LUTRA LUTRA NAIR, F. Cuv.

The Common Otter.

(Synonymy in No. 11.)

Pamber River, Kodaikanal, 7,000′, ♀ 1.

'This animal was caught by bait of raw meat. Its stomach contained 'crabs, decayed wood in plenty, bark and some leaves—a case of adap'tation to circumstances. These animals are never seen in the daytime.' C. McC.

(25) PETAURISTA PHILIPPENSIS, Ell.

The South Indian Flying Squirrel.

(Synonymy in No. 6.)

Palghat—Palagapandy Estate, ♀ 1 ; Karapara, ♀ 1 ; Shernelly, ? 1.
Palni Hills—Kodaikanal, ♀ 1 ; Tiger Shola, ♂ 2, ♀ 1.

'This animal lives in hollow trees during the day. No matter how the 'hollow is tapped or even has stones thrown into it on top of the animal, it 'refuses to come out, and has to be poked out. It has apparently only one 'young at a time.' C. McC.

(26) RATUFA INDICA MAXIMA, Schreb.

The Malabar Giant Squirrel.

(Synonymy in No. 33.)

Palghat—Cotengady Estate, ♂ 3, ♀ 5 ; Anamaad, ♂ 4, ♀ 2.
Ottacoolie Estate, ♀ 1 and 1 skull only.
Shernelly, ? 4.
Palni Hills—Gungavadorai, ♂ 1 ; Palni, ♀ 1 ; Tiger Shola, ♂ 1 ; Machur, 4,000′, ♂ 1, ♀ 1 ; Kukhal, 6,100′, ♂ 7, ♀ 7.

'The nest of this squirrel is composed of leaves and twigs lined inside with 'moss, which is scratched off the rocks or trees by the front feet and carried 'in the mouth to the nest. When alarmed they lie quite still and flat along 'the branch of the tree. Their cry is much sweeter than that of the ordinary '*Ratufa.*' C. McC.

(27) RATUFA MACROURA DANDOLENA, Thos and Wroughton.

The Grizzled Giant Squirrel.

(Synonymy in No. 13.)

Palni Hills, ♂ 5, ♀ 6 ; Kombu, ♂ 1, ♀ 2.

(28) FUNAMBULUS PALMARUM PALMARUM, L.

The Palm Squirrel.

(Synonymy in No. 2.)

Palni Hills, ♂ 1 ; Nellitorre, ♂ 1, ♀ 1 ; Perumal, ♂ 1, ♀ 1 ; Machur, ♂ 1, ♀ 2.

(29) FUNAMBULUS WROUGHTONI, Ryl.

The Coorg Striped Squirrel.

(Synonymy in No. 11.)

Cotengady Estate, ♂ 2, ♀ 6 ; Shernelly, ♂ 3, ♀ 4.

(30) FUNUMBULUS SUBLINEATUS, Waterh.

The Dusky Striped Squirrel.

(Synonymy in No. 11.)

Shernelly, ♂ 2 ; Kodaikanal, ♂ 1 ; Perumal, ♀ 1 ; Tiger Shola, ♀ 1 ; Shambanagur, 6,000′, ♂ 1, ♀ 1 ; Bombay Shola, 7,000′, ♂ 1.

'This animal is either not very shy or it is short-sighted, for close approach 'to it can be made without disturbing it. It feeds on the same trees as the big 'squirrels, e. g. *Eleocarpus tuberculatus*. It also plunders birds' nests.' C. McC.

(31) TATERA CUVIERI, Waterh.

The Madura Antelope Rat.

(Synonymy in No. 33, also Nos. 8 and 9, under *T. indica*.)

Nellitorre, ♂ 1 ; Vellapathy, ♂ 1, ♀ 1 ; Kombu, ♀ 1, juv.; Manapati, ♂ 1, ♀ 1, ? 1. Palni, ♀ 1, juv.

(32) GUNOMYS KOK, Gray.

The Southern Mole Rat.

(Synonymy in No. 1.)

Kukhal, 6,100′, ♂ 1.

(33) RATTUS RATTUS WROUGHTONI, Hint.

The Nilgiri Tree Rat.

(Synonymy in No. 33.)

Cotengady Estate, ♂ 32, ♀ 7; Palagapandy, ♂ 5, ♀ 4; Ottacoolie Estate, ♂ 1; Seetagundy, ♂ 5, ♀ 1; Karapara, ♂ 2, ♀ 3; Shernelly, ♂ 4, ♀ 5, ? 1. Vellapathy, ♂ 1; Pundi, ♂ 1, ♀ 1; Palni, ♂ 1; Kodaikanal, ♂ 3, ♀ 5; Perumal ♂ 5, ♀ 4; Shambaganur, ♂ 6, ♀ 4; Kukhal, ♀ 1. Silver Cascade, 5,800′, ♂ 4, ♀ 6.

(34) RATTUS RATTUS RUFESCENS, Gray.

The Common Indian Rat.

(Synonymy in No. 1.)

Cotengady Estate, ♂ 5, ♀ 2; Karapara, ? 1; Shernelly, ♂ 1, ♀ 1; Perumal, 5,000′, ♂ 3, ♀ 1.

(35) RATTUS BLANFORDI, Thos.

The White-tailed Rat.

(Synonymy in No. 2.)

Perumal, 5,000′, ♀ 1; Machur, 4,000′, ♂ 1, ♀ 2.

(36) CREMNOMYS AUSTRALIS SIVA, Thos.

The Mysore Rock Rat.

(Synonymy in No. 3, under *C. cutchicus*).

Kombu, ♂ 2, ♀ 1.

See notes on this genus by O. Thomas in *J. B. N. H. S.*, vol. xxiv, p. 239.

(37) MILLARDIA MELTADA, Gray.

The Soft-furred Field Rat.

(Synonymy in No. 1.)

Udamalpet, ♂ 2, ♀ 1; Palni, ♂ 1.

(38) LEGGADILLA PLATYTHRIX, Benn.

The Deccan Spiny Mouse.

(Synonymy in No. 1.)

Machur, in all, 12; Silver Cascade, in all, 1.

(39) MUS MUSCULUS, L.

The Common House Mouse.

(Synonymy in No. 1.)

Manapati, ♂ 1.

(40) LEGGADA PALNICA, Thos., sp. nov.

The Palni Hills Field Mouse.

1923. *Leggada palnica*, Thomas, *J.B.N.H.S.*, vol. xxix, No. 1, p. 87.
Kodaikanal, 7,000′, ♂ 1, ♀ 1; Shambaganur 6,000′, ♂ 3, ♀ 3.
Perumal, 5,000′, ♂ 1, ♀ 3; in al. 6; Silver Cascade, 5,800′, ♂ 1.

(41) LEGGADA BOODUGA, Gray.

The Southern Field Mouse.

(Synonymy in No. 1.)

Cotengady Estate, ♂ 2, ♀ 1; Karapara—? 1; Manapati, ♂ 3; Palni, ♂ 2.

(42) ACANTHION LEUCURUS, Sykes.

The Indian Porcupine.

Shambaganur, 6,000′, ♀ 1.

(43) LEPUS NIGRICOLLIS, F. Cuv.

The Black-naped Hare.

(Synonymy in No. 5.)

Cotengady Estate, ♂ 1, ♀ 1 ; Kombu, ♂ 1 ; Palni Hills, ♀ 1.

REPORT No. 44.

KANGRA AND CHAMBA

BY MRS. HELEN M. LINDSAY, M.A., B.SC.

COLLECTION ...	... No. 44.
LOCALITY ...	... Kangra and Chamba, Punjab.
DATE ...	... February 1922-January 1923.
COLLECTED BY ...	... Mr. H. W. Wells.

Collections have already been made along the areas of the Himalayan range, viz. :—Bhutan Duars (No. 27), Sikkim (No. 23), Darjeeling (No. 26), Nepal (No. 37), Kumaon (No. 15). This present collection continues the series, and represents the tract which abuts on Kashmir, towards the Western end of this huge hill system.

The places visited by Mr. Wells form six groups.

(1) KANGRA DISTRICT, an area of 9,978 sq miles lying between 31° 21′ and 32° 59′ N. and 75° 37′ and 78° 42′ E. The Gazetteer notes that it shows two distinct tracts :—(*a*) the Western block of Kangra proper—' an irregular triangle whose base lies on the Hoshiarpur border, while Chambi and Mandi constrict its apex to a narrow neck known as Bangabal, which is at one point less than ten miles wide.' (*b*) The eastern block which embraces the Kulu sub-division comprising the tahsils of Kulu and Saraj, also the mid-Himalayan cantons of Lahul and Spiti. More important in population and cultivation and covering an area of 2,939 sq. miles, the first of these tracts has two wide fertile valleys, the Kangra Valley between the Dhaola Dhar and the long irregular mass of lower hills which run almost parallel to the Dhaola Dhar from north-west to south south-east famous for its beauty due to the everchanging views of this mountain whose snowy peaks rise above the valley up to 13,000′ ; the other valley runs between these hills and the Sola Singhi range, thus lying parallel to the first.

(2) JAGATSUKH, the largest valley in Kulu, Mr. Wells notes, is well-wooded up to 10,000′, then it narrows to less than ½ mile being more open, with here and there patches of forest, consisting chiefly of sycamore and a species of *Lauristinus*. These patches invariably cover a mass of huge rocks where *Ochotona* make their homes. Up to 7,500′ the chief trees are the holly oak, then forests of deodar mingled with small patches of maple and Indian Horse-chestnut which with their bright green leaves show up in strong contrast to the dark green of the deodars.

(3) LAHUL, also in the Kulu sub-division, comprises 1,764 sq. miles bounded on the north by the Ladakh province of Kashmir, and on the west by Chamba State. It includes the headwaters of the Chenab River, which begins from the Bara Lacha Pass, 16,500′, on the north-east border, in two branches flowing with a general south-west direction till they meet to form the main stream at Tandi. These branches, known as the Chandra and the Bhaga, enclose a great triangular mass of mountains consisting of one almost unbroken icefield with impassable barriers of naked rock. South of the highest peak, 21,415′ above sea-level, a glacier stretches downwards for a distance of 12 miles. This mass forms the centre of the canton and is united with the north and east ranges at Bara Lacha Pass. The main axis of the centre mass lies from north to south with a branch going west. Lateral spurs fringe these two lines, all the intervening valleys being filled with glaciers. The whole country is higher than Kulu, for the peaks rise here to 21,000′ and include the Gyephong Peak which can be seen from Simla.

The Bara Lacha Pass is an important feature in the general configuration of the country. It is nearly five miles long and consists of a high neck of land connecting the central mountains with the main Himalayas. The name in Tibetan means ' pass with cross roads on the summit ' from the fact that roads from Zangshar, Ladakh, Spiti, and Lahul all meet on the top. Kyelang, the chief village of Lahul, lies on the trade route between the Rohtang Pass from Kulu and the Bara Lacha Pass into Lahul.

'The scenery in Lahul is almost oppressive in its beauty and grandeur, the country being wild and desolate, for the villages and cultivated lands are mere specks up vast mountain slopes. But there is something pretty and smiling about the near view of the villages, composed of flat-roofed houses, clumps of pollard willows standing in plots of green turf with terraced fields neatly kept. On the banks of the fields under the small canals are the "dang" or hayfields in which the grass grows luxuriantly, mixed with bright flowers as in an English meadow, with here and there wild roses, crimson and yellow, and wild currant and gooseberry bushes. Wherever water is brought this verdure springs up, but without irrigation crops are impossible and grass extremely scanty. At Gondla on the Chandra River the mountains on the left bank rise abruptly in a stupendous precipice nearly 4,000′ sheer. This is considered one of the most impressive sights in the world.'

(4) PATTAN VALLEY, LAHUL, runs practically due east and west from the junction of the Chandra and Bhaga Rivers, and the Chandrabagha (as the upper waters of the Chenab River are called) flows through its entire length till it reaches Chamba territory beyond Triloknath. The average elevation of the valley is about 10,000′, but on either side the mountains tower abruptly up to 16,000′ and even 18,000′. Pattan is the most thickly populated part of Lahul, villages and cornfields forming a continuous broad band along the right bank of the river, which is the only part where cultivation is possible. With the exception of the willow groves round the villages the country remains absolutely sterile.

Distinct from that of Kulu, the flora of Lahul is all of an Alpine nature owing to the perennial desiccation of the country caused by strong winds and scanty rainfall during the growing time from April to September. The varieties are very limited in number, and almost all the herbs have covering of hairs and long root systems for protection against drought. At 11,000′ juniper grows freely in sheltered places, but beyond this the hillsides continue to be absolutely devoid of tree or bush of any sort. North-east of the Bara Lacha Pass lies the plain of Lingti a huge alluvial stretch at the junction of three streams. The soil here appears to be alkaline and the flora differs in consequence from the rest of Lahul. On the plain itself the vegetation is limited to a Caragana which on the sandy wastes at the northern end forms mounds of spiny scrub with a golden papery bark and typical legumes. A few plants of *Gentianaceæ*, *Compositæ*, and *Boraginaceæ* occur near the streams. The huge screes near the main ridge close to Kyelang have a flora quite their own, composed of species of *Stellaria*, *Silene*, *Astrologus*, *Meconopsia*, *Salvia*, *Borages* and *Primulaceous* plants with occasional shrub of *Salix*.

The climate of Lahul is very bracing, for the air is crisp and keen especially in the valley of the Chandra. The average rainfall is 23 inches.

(5) DHAMTAL in Pathankote about 25 miles from Kangra, is a small reserved forest consisting of low bamboo jungle interspersed with deciduous trees among dense thorny undergrowth.

(6) CHAMBA STATE, with its main town of Chamba, seventy miles from Pathankote, is wholly mountainous and exhibits all the characteristics of the North-west Himalayas. Along the S. margin of this region are found the Lower Siwalik or Nahan sandstones and the Upper Siwalik conglomerates, the Nahan series predominating. The State has an almost purely Tibetan flora. In these mountain tracts are found bear (black and brown), ibex, leopards, Kashmir stag, goral, barking deer, serow, and snow leopard.

In this whole area of Kangra and Chamba, the Gazetteer says, three sets of stratified rocks of the Himalayas are found.

(1) Spiti shows the Tibetan zone of Cambrian series with Cretaceous rocks to the north. There is a granite range between Spiti and Kulu.

(2) The central zone is slates and conglomerates and limestone.

(3) The sub-Himalayan zone of shales and sandstones of Lower Tertiary (Sirmur series) and sandstones and conglomerates belonging to the Upper Tertiary Siwalik series. Gypsum occurs in Lower Spiti.

The Beas is the chief river of Kangra District. Rising in the Kulu snow ranges it traverses the native state of Mandi, flowing south-west through Kangra and debouching upon the plain at Mirthal Hat near Hajipur. Reports say that the valley of the Upper Beas is favourably situated for sheltering many kinds of wild life usually found in temperate climates. From a list of these printed in 1917, the following mammals are said to occur:—Bears (red and black) panthers, wild cats, hyænas, jackals, foxes, pinemartens, weasels, otters, wild pig, porcupine, wild sheep and goats, large and small flying squirrels, flying foxes, monkeys (macaques and langurs) musk and barking deer, goral.

The average rainfall of Kangra is 70 in. but the amount varies locally to a great extent. Lahul and Spiti are almost rainless, glacier streams being the chief source of water. The forests of Kulu resemble those of adjacent parts of the Himalayas. There are some fine though not extensive alder woods in the Beas Valley up to 6,000′ ; then occur blue pine, spruce and fir to 11,000′ then brown oak and silver fir to 11,500′ after which only birch and mauve rhododendron occur in any quantity but with them are mixed willow, mountain ash, and wild apple.

Mr. Wells notes the difficulty of collection of mammals in these areas owing to the habits of a criminal tribe of Bangalis who are constantly hunting about with muzzle loaders and packs of mongrel dogs. Each man usually has six dogs. This people eat everything they catch, even civets and jackals. The Gaddis, a pastoral hill tribe moving about with their flocks, and the Kanet tribes, who trap creatures, using the method of long rough fences with openings at intervals in which are set snares and deadfalls, also drive away all game. From the foregoing description of the country, which has been drawn from the diaries of Mr. Wells and the Gazetteer, it can easily be understood that creatures are scare in these regions, since there is so little food available for their sustenance, and conditions are altogether so unfavourable for their life. Still Mr. Wells was successful in obtaining 1,237 specimens which belong to 39 genera in 53 species. These were got in the following localities :—

KANGRA VALLEY ...	Gopalpur, Guggal, Palampur (5,000′), Kangra Fort, Baijnath, Triun, Samayala, Dharmsala.
KULU	Kothi (8,500′), Naggar, Sultanpur, Manali, (6,200′), Rahla (8,840′), Jagatsukh (6,000′-14,000′).
LAHUL	Lingti, Sissu, Kyelang (10,380′), Patseo, Koksar, Gondla, Kyiutung, Pattan Valley (10,000′), Chirot.
PATHANKOTE ...	Dhamtal (2,800′).
CHAMBA	Chatri, Tissa Range with Chalan, Siul, Siluni, Dedlah.

(1) MACACA MULATTA, Zimm.

The Rhesus.

(Synonymy in No. 7 under *M. rhesus.*)

Dharmsala, ♂ 1 ; Samayala (5,000′), ♂ 2 ; Gopalpur, ♂ 1.

These monkeys are fairly common, frequenting the rocky hillside and cliffs bordering the streams. They are difficult to catch as their habit of robbing the fields and gardens makes the local people drive them away.

(2) PITHECUS ENTELLUS, Dufresne.

The Langur.

(Synonymy in No. 1.)

Chichian (9,000′), ♀ 1 ; Gopalpur (9,000′), ♂ 1, juv. ; Samayala, ♀ 1 ; Rahla, ♀ 2 ; Jagatsukh (11,000′), ♀ 1 ; Kangra, ♂ 1, juv., ♀ 1 ; Kangra, Fort, ♂ 1 ; Chatri (6,000′), ♂ 1, ♀ 1, juv. ; Chalan Tissa (6,700′), ♂ 2 ; Bara Tissa (7,500′), ♂ 1 ; Deolah, ♂ 1.

At Kangra Mr. Wells notes, 'the absence of adult males is particularly noticeable, only one really adult specimen having been seen with this group, although there are numbers of females with young and also young males.' The muscular development of the large male from Kangra was noteworthy, the biceps being quite as large as an ordinary man's.

Measurements of this specimen :—

Head and Body, 780 ; tail, 860 ; Hind Foot, 218 ; Ear, 37.

Weight, 46 lbs. Fur long and dense, not darker on feet but much darker on arms and back of hands. Fur of head, whitish.

(3) PTEROPUS GIGANTEUS, Bruenn.

The Common Flying Fox.

(Synonymy in No. 2.)

Kotla (3,100′), ♀ 8 ; Gopalpur, ♂ 1, ♀ 4.

No lice were found on the specimens from Kotla. The male specimen differs from the females in that the fur on the lower back is chocolate instead of blackish, and the forearm when fresh is 10‴ longer.

(4) RHINOLOPHUS FERRUM-EQUINUM TRAGATUS, Hodgs.

Hodgson's Horse-shoe Bat.

Manali (6,500′), ♂ 2, ♀ 21.

These bats were caught under a large rock. Their colour is light brown to fulvous above, paler beneath.

Head and body, 70 ; tail, 33 ; forearm, 62 ; ear, 24.

(5) NYCTALUS LABIATUS, Hodgs.

The Indian Noctule Bat.

Kangra, ♂ 1 ; Sissu, Lahul (10,000′), ♂ 1.

The colour is chocolate brown above, paler beneath. The wings are hairy inside to the thumb.

Head and body, 69 ; tail, 53 ; forearm, 55 ; ear, 13.

(6) NYCTALUS LEISLERI, Kuhl.

The Hairy-armed Noctule.

1817. *Vespertilio leisleri*, Kuhl, Deutsch, Federn, p. 38.
1872. *Vesperugo Oleisleri*, Hutton, P.Z.S., p. 707.
1888. *Vesperugo leisleri*, Blanford, Mamm. No. 182.

Chamba (3,300′), ♀ 1.

The subgeneric name of *Nyctalus* was given by T. Ed. Bowdick in 1823.

(7) PIPISTRELLUS BABU, Thos.

The Babu Pipistrelle.

(Synonymy in No. 26.)

Gopalpur, ♂ 2.

(8) MYOTIS MURICOLA, GRAY.

The Wall Bat.

(Synonymy in No. 17.)

Chirot, Pattan Valley (10,000′), ♀ 1.

(9) MYOTIS CALIGINOSUS, Tomes.

Tomes' Whiskered Bat.

(Synonymy in No. 23.)

Chatri, Chamba (6,000′), ♀ 3 ; Samayala, ♀ 4.

(10) PACHYURA, Sp.

Gopalpur, ♂ 3, ♀ 1 ; Dhamtal, ♂ 11, ♀ 8, in alcohol 1.
Chamba (3,300′), ♂ 1, ♀ 4.

(11) PACHYURA HODGSONI, Blyth.

The Himalayan Pigmy Shrew.

(Synonymy in No. 15.)

Dhamtal (2,800′), ♂ 1.

(12) CROCIDURA RUBRICOSA, And.

Anderson's Assam Shrew.

(Synonymy in No. 25.)

Tissa (6,300′), ♀ 1 ; in alcohol 1.

(13) CROCIDURA KINGIANA, Anderson.

King's Shrew.

(Synonymy in No. 15.)

Rahla (9,000′), ♂ 2; Jagatsukh (11,000′), ♂ 3; Chirot (9,700′), ♀ 1, juv.

(14) FELIS PARDUS, L.

The Panther.

(Synonymy in No. 5.)

Dharmsala (4,000′), ♂ 3, ♀ 1 immature.

(15) FELIS DOMESTICUS.

The Domestic Cat.

(Synonymy in No. 9.)

Gopalpur, ♂ 2.

The colour is much darker than typical *Felis chaus* also more striped.

(16) FELIS AFFINIS, Gray.

The Jungle Cat.

(Synonymy in No. 1.)

Gopalpur, ♀ 3; Dhamtal, ♂ 1; Dharmsala (5,500′), ♀ 1.

(17) VIVERRICULA MALACCENSIS, Gmel.

The Small Indian Civet.

(Synonymy in No. 3.)

Kangra, ♂ 2, ♀ 2; Kangra Fort, ♂ 1, ♀ 1.

The Bangalis rather spoil the specimens by making a ventral cut to obtain the civet pouch which they sell for medicine. These civets are of a golden brown colour, the whitish tips of some of the hairs giving a greyish appearance. Markings are very indefinite, except on the tail which is whitish-brown, having five or six broad black rings. The feet are black, and the skins are saturated with grease.

(18) PARADOXURUS NIGER, Desm.

The Indian Toddy Cat.

(Synonymy in No. 5.)

Gopalpur, ♂ 2; Kangra, ♂ 3, ♀ 3.

This civet is a nightly visitor to the fowl houses around and also it is said to enter shops to steal sugar. Mr. Wells could not catch these creatures in traps though he tried all sorts of bait. The females are rather more greyish on the back than usual and the black lineal stripes are very distinct. These stripes show up more as the civet is shedding its winter coat, the fur then being fairly thin and straggly, very different to the usual appearance.

(19) PAGUMA GRAYI, Benn.

The Himalayan Palm Civet.

(Synonymy in No. 15.)

Pangi (9,000′), ♂ 1; Deolah (6,000′), ♂ 1.

(20) HERPESTES EDWARDSI FERRUGINEUS, Blanf.

Blanford's Indian Mongoose.

(Synonymy in No. 24.)

Chamba, ♂ 1, ♀ 3; Gopalpur, ♀ 2; Kangra, ♂ 13, ♀ 7; Guggal, ♂ 1, ♀ 1; Samayala, ♂ 1; Dhamtal, ♀ 1.

The specimen from Samayala weighed 4 lbs.

(21) CANIS AUREUS, L.

The Jackal.

(Synonymy in No. 1.)

Gopalpur, ♂ 2; Kothi (8,500′), ♂ 1; Dhamtal, ♂ 1, ♀ 1; Siluni, ♀ 1.

These hill jackals seem to be of a slightly smaller build than those of the plains. Their measurements are the same as Blanford's young ♀ from Rajputana, thus:

Head and body, 790; tail, 240; hind foot, 150; ear, 80.

(22) VULPES BENGALENSIS, Shaw.

The Indian Fox.

(Synonymy in No. 1.)

Gopalpur, ♀ 1 ; Kangra, ♀ 2.

(23) VULPES MONTANA, Pearson.

The Hill Fox.

(Synonymy in No. 15.)

Chatri, ♀ 1 ; Bara Tissa (7,500′), ♂ 1, ♀ 1 ; Chalan Tissa (6,700′), ♀ 3, Pukri, ♂ 1, ♀ 1 ; Siluni, ♂ 1 ; Gopalpur, ♂ 2 ; Baijnath, 1 juv. ; Samayala, ♀ 1.

One male specimen measured. Head and body, 670 ; tail, 445 ; hind foot, 147 ; ear, 95 ; weight, 11¼ lbs.

(24) CHARRONIA FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Tissa Range (5,400′), ♀ 1 ; Chalan Tissa, ♀ 1 ; Tissa (6,400′), ♂ 1, Kothi (8,000′), ♀ 1.

These are said to be common but are seldom seen.

(25) MARTES FOINA, Erxl.

The Beech Marten.

1777. *Mustela foina*, Erxleben, *Syst. Regn. An.*, p. 458.
1820. *Martes foina*, Nilsson, *Faun. Scand.*, 1, p. 38.
1889. *Mustela foina*, Blanford, Mamm., No. 78.

Kyelang 1, unsexed.

Hitherto not taken by the Mammal Survey.

(26) MUSTELA WHITEHEADI, Wr.

The Indian Stoat.

1889. *Putrius erminea*, Blanford, Mamm., No. 81.
1908. *Mustela whiteheadi*, Wroughton, *J.B.N.H.S.*, vol. xviii, p. 882.

Gondla, ♂ 1.

This is the first occasion on which this animal, the Indian representative of the European stoat, has been taken by the Mammal Survey.

(27) MUSTELA CANIGULA, Hodgs.

The White-nosed Weasel.

1842. *Mustela canigula*, Hodgson, *J.A.S.B.*, vol. xi, p. 279.
1843. *Mustela hodgsoni*, Gray, *A.M.N.H.*, vol. xi, p. 118.
1888. *Putorius canigala*, Blanford, Mamm., No. 83.

Bara Tissa (7,500′), ♂ 1.

Hitherto not taken by the Mammal Survey.

(28) MUSTELA TEMON, Hodgs.

The Pale Weasel.

1823. *Mustela alpina*, Gebler, *Mem. Soc. Imp. Nat. Mus.*, vol. vi, p. 213.
1857. *Mustela temou*, Hodgson, *J.A.S.B.*, vol. xxvi, p. 207.
1889. *Putorius alpinus*, Blanford, Mamm., No. 84.

Pattan Valley (10,000′), ♀ 2 ; Kielang 1, lunsexed.

This is the first time this weasel has been taken by the Survey. The ♀ was shot through the anal glands, and there was a most fetid smell all over the fur. This weasel is by no means common, but when the snow is deep in winter a few are generally killed, mostly near villages. It lives in holes amongst rocks and feeds on small animals and birds, especially chukor. The colour is reddish brown on back and tail, dirty white beneath. Soles of feet hairy.

Measurements :—

Head and body, 222 ; tail, 122 ; hind foot, 57·5 ; ear, 22 ; Weight, 4·5 ozs., 4 pairs of mammæ.

(29) LUTRA LUTRA NAIR, F. Cuv.

The Common Otter.

(Synonymy in No. 11.)

Dhamtal (2,000′), ♀ 1.

This other must have been a stray one from the Beas River some miles away as the Chakhi River has no fish of a size worth its catching. An otter is never attracted by bait.

(30) PETAURISTA INORNATUS, Geoff.

The Kashmir Flying Squirrel.

(See Report No. 42.)

1844. *Sciuroterus inornatus*, Geoff., *Voy. Jacq. Zool.*, p. 62.
1888. *Pteromys inornatus*, Blanford, Mamm., No. 228.
Chalan Tissa, ♂ 1.

(31) PETAURISTA FULVINUS, Wr.

Hodgson's Flying Squirrel.

1834. *Pteromys albiventer*, Gray. *Ill. Ind. Zool.*, vol. ii, pl. 18.
1911. *Petaurista fulvinus*, Wroughton. *J.B.N.H.S.*, vol. xx, No. 4, p. 1021.
Jalori, ♀ 1; Dharmsala (2,000′), 1 unsexed; Triun (9,800′), ♂ 1; Kothi (8,400′), ♂ 3; Rahla (8,840′), ♂ 6.

This is the first time this species, described by Mr. Wroughton from material collected in Simla and presented by A. O. Hume, Esq., has been obtained for the Survey. According to Mr. Wroughton it represents in the Western Himalayas the species *albiventer* described in Report No. 14 from Naini Tal, and it is quite distinct from the species *inornatus* of No. 42 from Kashmir. 'These squirrels possess remarkable powers of guidance, performing quite a series of evolutions, gliding round first in an almost complete circle and then launching itself again in the form of S. before finally coming to rest on a dead tree. These squirrels often spend the day roosting on branches of fir trees, generally in the angle formed by a branch with the trunk, so that it is impossible to spot them. The only cry I have heard is a faint squeak, uttered 3 or 4 times just before taking flight.' H.W.W.

(32) EOGLAUCOMYS FIMBRIATUS, Gray.

The Smaller Kashmir Flying Squirrel.

(See Report No. 42.)

1837. *Sciuropterus fimbriatus*, Gray, *Charlesworth's Mag.*, vol. i, p. 584.
1889. *Sciuropterus fimbriatus*, Blanford, Mamm., No. 233.
Naggar Castle, ♂ 1, ♀ 1; Pangi, Chamba, 1 unsexed.

(33) FUNAMBULUS PENNANTI, Wr.

The Common Five-striped Squirrel.

(Synonymy in No. 1.)

Dhamtal (2,800′), ♂ 5, ♀ 5.

(34) MARMOTA HIMALAYANA, Hodgs.

The Tibet Marmot.

(Synonymy in No. 23.)

Patseo, ♂ 1, ♀ 1; Kyelang, ♂ 2, ♀ 1; Lingti Plain, ♂ 11, ♀ 11.

(35) TATERA INDICA, Hardw.

The Indian Gerbil.

(Synonymy in No. 1.)

Dhamtal, ♂ 34, ♀ 30.

These *Tatera* are of a greyish fawn colour on the back, the basal two-thirds of the hair being ashy. Tips of hairs on back grey, underneath pure white. Hind feet above white, soles naked and slightly annulated. The breeding season is in May and June and from 3-5 young are born. The tip of the tail has longer black hairs.

Measurements are :—

Head and body, 170; tail, 190; hindfoot, 37; ear, 23; mammæ, 2-2 = 8.

(36) GUNOMYS WARDI, Thos.

The Kashmir Mole-Rat.

1908. *Gunomys wardi*, Thomas, *J.B.N.H.S.*, vol. xviii, No. 4, p. 745.

Siluni, ♂ 3, ♀ 1 ; Tissa, ♂ 1, ♀ 1 ; Deolah, ♂ 1 ; Siul River (4,000′), ♂ 1, ♀ 1 ; Chamba (3,300′), 1 unsexed ; Dharmsala, ♂ 1 ; Gopalpur, ♂ 5, ♀ 4 ; Dhamtal, ♂ 2, juv., ♀ 8 (4 juv.).

Only one animal was caught at each burrow which bears out Blanford's observations.

(37) RATTUS RATTUS GANGUTRIANUS, Hint.

The Common White-bellied Indian Rat.

(Synonymy in No. 1 under *R. rufescens*.)

(See also Scientific Results by M. C. Hinton, *J.B.N.H.S.*, vol. xxvi, pp. 56 and 384).

Chamba, ♂ 9, ♀ 7 ; Deolah, ♀ 1 ; Bara Tissa, ♂ 1 ; Gopalpur, ♂ 3, ♀ 4 ; Dhamtal, ♀ 1 ; Dharmsala, ♂ 1, ♀ 2 ; Kangra, ♂ 1 ; Pattan Valley, ♀ 2 ; Jagatsukh, ♂ 1 ; Kyelang, ♂ 1.

'This rat burrows in rice fields during the rice harvest. The cultivators say it is migratory.'

(38) RATTUS RATTUS RUFESCENS, Gray.

The Common Indian Rat.

(Synonymy in No. 1.)

Dhamtal, ♂ 1, ♀ 3.

(39) RATTUS VICERTEX, Bonh.

The North Asian Rat.

(Synonymy in No. 15.)

Chatri, ♂ 9, ♀ 6 ; Kalhel, ♂ 1 ; Bara Tissa, ♂ 11, ♀ 9 ; Chalan Tissa, ♂ 6, ♀ 4 ; Deolah, ♂ 4, ♀ 10 ; Siul River, ♂ 1, ♀ 4 ; Gopalpur, ♂ 1 ; Rahla, ♂ 3, ♀ 3 ; Chirot, ♂ 1, juv. ; Kothi, ♀ 2 ; Jagatsukh, ♂ 4, ♀ 4 (1 juv.) ; Samayala, ♀ 1 ; Kyelang, ♀ 1 ; Pattan Valley, ♂ 2, ♀ 6.

(40) RATTUS FULVESCENS, Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

Chatri, ♂ 4, ♀ 2 ; Bara Tissa, ♂ 2 ; Chalan Tissa, ♂ 23, ♀ 15 ; Deolah, ♂ 7, ♀ 9, in alcohol 2.

(41) MILLARDIA MELTADA PALLIDIOR, Ryl.

The Northern Soft-furred Field Rat.

(Synonymy in No. 12.)

Gopalpur, ♂ 2, ♀ 2 ; Dhamtal, ♂ 12, ♀ 5, in alcohol 5.

(42) LEGGADILLA PLATYTHRIX, Benn.

The Deccan Spiny Mouse.

(Synonymy in No. 1.)

Dharmsala, ♂ 1 ; Kangra Fort, ♂ 25, ♀ 17 ; Kangra, ♂ 1 ; Dhamtal, ♂ 20, ♀ 28, unsexed 2.

(43) MUS MUSCULUS, L.

The Indian House-Mouse.

(Synonymy in No. 15.)

Gopalpur, ♂ 1 ; Dhamtal, ♂ 4, ♀ 6.

(44) MUS HOMOURUS, Hodgs.

The Himalayan House-Mouse.

(Synonymy in No. 15.)

Chamba, ♂ 12, ♂ 6 ; Chatri, ♂ 4 ; Siluni, ♂ 4, ♀ 1 ; Tissa, ♂ 16, ♀ 10 ; Bara Tissa, ♂ 3, ♀ 2 ; Chalan Tissa, ♂ 1, ♀ 1 ; Deolah, ♂ 4, ♀ 1 ; Kalhel, ♂ 3, in alcohol 3.

(45) LEGGADA BOODUGA, Gray.

The Southern Field Mouse.

(Synonymy in No. 1.)

Gopalpur, ♀ 4, 1 unsexed.

'It lives in burrows amongst grass and stones, or in hedgerows.'

(46) GOLUNDA ELLIOTI MYOTHRIX, Hodgs.

The North Indian Bush Rat.

1837 *Golunda ellioti*, Gray, *Charlesworth's Mag. N.H.*, vol. i, p. 586.
1845 *Mus myothrix*, Hodgson, *A.M.N.H.*, vol. xv, p. 267.
1888 *Golunda ellioti*, Blanford. Mamm., No. 299.
1923 *Golunda ellioti myothrix*, Thomas, *J.B.N.H.S.*, vol. xxix, No.2, p. 376.

Gopalpur, ♂ 3, ♀ 5; Kangra Fort, ♀ 1; Dharmsala, ♀ 2; Kangra, ♂ 1, ♀ 1; Samayala, ♀ 1; Dhamtal, ♂ 9, ♀ 18.

'The Stomachs were frequently full of a small purple berry that grows on the scrub.'

(47) APODEMUS SYLVATICUS GRISEUS, True.

The Long-tailed Field Mouse.

(Synonymy in No. 15.)

Pattan Valley, ♂ 2, ♀ 2; Chirot, ♂ 2, ♀ 10; Koksar, ♂ 1; Kyelang, ♂ 7, ♀ 6; Gondla, ♀ 2; Jagatsukh, ♂ 58, ♀ 75; Rahla, ♂ 25, ♀ 17; Kothi, ♀ 3.

(48) MICROTUS (HYPERACRIUS) WYNNEI, Blanf.

Rahla, ♂ 7, ♀ 11; Jagatsukh, ♂ 7, ♀ 8; Sissu, ♂ 1, ♀ 1; Koksar, ♂ 1; Kyelang, ♂ 5, ♀ 2; Zinzinghar, ♂ 1; Vispa, ♀ 2; Pattan Valley, ♂ 4, ♀9; Patseo, ♀ 1; Gondla, ♀ 1; Kyelang, ♀ 3; Lingti Plain, ♂ 1, ♀ 6.

This collection is under consideration.

(49) ACANTHION LEUCURUS, Sykes.

The Indian Porcupine.

(Synonymy in No. 1 under *Hystrix leucura.*)

Kangra Fort, ♂ 1, ♀ 1.

These porcupines weighed ♂ 32 lbs., ♀ 31 lbs., Mr. Wells says that they cannot be caught in gins.

(50) LEPUS RUFICAUDATUS, Geoff.

The Commn Indian Hare.

(Synonymy in No. 15.)

Samayala, ♂ 1.

(51) OCHOTONA ROYLEI, Ogilvy.

The Himalayan Mouse Hare.

(Synonymy in No. 15.)

Triun, ♂ 2; Rahla, ♂ 1, ♀ 1; Jagatsukh, ♂ 22, ♀ 25; Vispa, ♂ 1, ♀ 1; Losar, 1 unsexed; Pattan Valley, ♂ 5, ♀ 4; Chirot, ♂ 5, ♀ 7.

'These creatures live in holes among rocks and stones on the open hillsides. Their presence may always be recognized by their habit of depositing their droppings at the mouth of the burrows. The droppings are quite distinct, being small and spherical, unlike any other small mammals in this area. They breed during July and August the time varying with the elevation, and have from 3–5 young.

Measurements :—

Head and body, 162; tail, 8; hind foot, 32; ear, 24.'

Mr. Wells found a large white grub embedded beneath the skin of the abdomen, very much alive and measuring 23 mm. long, 12 mm. broad. One mouse hare had 9 of these just under the skin.

'The cry is a weak piping sound of one note, uttered at intervals, inaudible 15 or 26 yds. away.' H. W. W.

(52) NEMORHŒDUS GORAL, Hardw.

The Grey Himalayan Goral.

(Synonymy in No. 15.)

Kalhel, ♂ 1 ; Jagatsukh, ♀ 1.

'The ♀ was of a brownish grey colour, having a black dorsal line down the neck and back, much more pronounced on the neck. The throat was white with a black patch on the chest and front of forelegs also black. The cry is peculiar, something like the noise of a file scraped on a piece of tin. It is very abrupt and is often uttered 10–15 times.

Measurements :—

Head and body, 1235 ; tail, 140 ; hind foot, 285 ; ear, 120.

(53) MUNTIACUS VAGINALIS, Bodd.

The Barking Deer.

(Synonymy in No. 2.)

Kotla, Kangra—(2300′), ♀ 1.

As in the case of Sikkim (No. 23) and Kumaon (No. 15) this collection from Kangra and Chamba contains representatives of both the Gangetic Plain and the Himalayas. Mr. Wroughton in No. 23 points out that '*Vulpes bengalensis* and *Funambulus pennanti* are characteristic of the plains fauna, while *Vulpes montana*, *Ochotona*, and *Microtus* are exclusively Himalayan.' All these species are present in this collection, which has too for the first time for this Survey specimens of *Martes foina*, *Mustela whiteheadi*, *Mustela canigula*, *Mustela temon*, and *Petaurista fulvinus*. A specimen of *Moschus moschiferus* was brought to Mr. Wells by a shikari. The musk pod had been cut out immediately after the death of the animal since it contracts and forces the essence out, so that the musk loses its value on contact with the air. The musk fetches a fairly good price since the Kulu people use it extensively as a medicine, especially in cases of pneumonia, taking a small pinch of it with their food.

REPORT NO. 45

THE PUNJAB SALT RANGE AND MURREE

BY MRS. HELEN M. LINDSAY, M.A., B.SC.

COLLECTION	... ...	No. 45
LOCALITY	... ...	Salt Range and Murree, Punjab.
DATE	... ...	1st February–18th June, 1923.
COLLECTED BY	... ...	Mr. H. W. Wells.

In Report No. 42, dealing with Major Stockley's collection, part of the ground covered by this present set of specimens has already been described. But by far the greater number of the specimens was obtained by Mr. Wells from the area of the Punjab Salt Range which merits description on account of its distinct character.

The Salt Range is the name given to the hill system in the Jhelum, Shahpur, and Mianwali Districts of the Punjab, deriving its name from the great deposits of rock salt, the largest known in the world, and extending from 32° 41′ to 32° 56′ N. and 71° 50′ to 74° E. It was known to the ancients as the Makhialah hills and the Koh-i-jud. This range, Mr. Wells says, 'first enters the Jhelum District at its extreme south-west corner where the spurs of Mount Sakesar descend into the village of Lawa and the whole lower boundary of Tahsil Talagang is fringed by the northern ridges of the hills. In this part of its course the range keeps mostly to the district of Shahpur, but when it reaches the boundary of Tahsil Pind Dadan Khan, it passes altogether into the Jhelum District. Here it consists of two distinct lines of hills running west and east at a distance from each other of five miles each made up of a number of parallel ridges though this parallelism is modified by a marked tendency to a linked and looped formation.

A striking feature of the Pind Dadan Khan Hills is the series of plateaux they enclose. The two parallel ridges, from 2,500′ to 3,700′ in height, support between them at an elevation averaging 3,500′ a series of fairly level uplands, richly cultivated and carrying a dense population. In the midst nestles the beautiful lake of Kallar Kahar. The rocks which build up the range are throughout tilted at a very high angle, but there are few peaks which are either detached or conspicuous. On the south the range presents a monotonous line of parched and barren slopes, rarely more than 700′ descending abruptly to the valley of the Jhelum River, whilst on the other side they gradually sink down into the Chakwal Plateau, a country itself lying at levels from 1,300′ to 1,900′.

With these differences of altitude in the surrounding country, the appearance of the range differs greatly at different standpoints. Thus from the south the view is dreary, the hills being almost devoid of vegetation with a few half-starved and sickly bushes to emphasize the general barrenness which is not relieved by much grandeur of form. In fact the east side of the range is decidedly tame, but towards the west where the limestone rocks become predominant, there are often long lines of lofty cliffs best seen in the narrow gorges which carry down the drainage of the interior upland to the Jhelum. Of these the Nilli Vahn near Kandwal is one of the finest examples, but, imposing as some of these gorges are, they are too barren and desolate to be called beautiful. On the north side of the mountains the plain country lies high and the range has the appearance of a low mountainous ridge broken at long intervals by the higher peaks such as Chal and Karangal. The drainage gathers into small lakes, and there is a fuller vegetation, for the long slopes of the hills are often covered with low brushwood and a good deal of wild olive. Trees are very rare since the rainfall is scanty and the surface soil merely bare rock or stony debris.

Throughout all these ranges, the main hills are frequently belted sometimes on both sides, by a broad band of hard clay ravines, often of considerable depth, which all run parallel to the mountains and thus to one another. They are a hard, nodular marl, dusky red in colour and almost bare of vegetation. The only river is the Jhelum which forms the east and south boundaries and skirts the district for about 120 miles.

The Gazetteer states that ' few areas are of greater geological interest than ' the Salt Range, the sedimentary rocks in which have yielded fossils ranging ' from Cambrian to Tertiary series, while the deposits of rock salt constitute one ' of the most difficult problems with which the Indian geologist has to deal.' The lowest bed is the salt marl and rock salt which affords the material for an extensive mining industry. The flora of the area is not important. *Dalbergia sissoo* grows in the riverain tract, especially round Jhelum, and *Acacia arabica* is common all through the alluvial plain, though it does not succeed in the hills probably owing to the severe winter frosts. *Acacia modesta* is the commonest tree in the hills and on the plateau. Rawalpindi has its predominating vegetation, Oriental and European in character, and not Himalayan. Thus one finds there species of *Resedaceæ*, many species of *Cruciferæ* and also the remarkable palm, *Nūnnarrhops ritchieana*, for which the Salt Range is the north-east limit.

The fauna of the Salt Range is not extensive. At intervals leopards occur, preying chiefly on the Urial or mountain sheep. Hyænas and jackals are not common, while near Tilla a badger is said to be found. Some years ago a curious animal was brought in for reward in the West Salt Range It was about the size of an ordinary village dog, light yellow in colour with a catlike head and long pointed ears, probably some kind of lynx. The characteristic big game shooting of the district is afforded by the urial found in herds of from 6 to 12. Large heads are not now common, 23 in. or 24 in. being considered good. Wild pig, cats, and foxes are sometimes found, also porcupines, hares and hedgehogs. There are no monkeys in this area, the ' langurs ' talked about at Choa Saidan Shah and naturally supposed by those who have not seen them to be monkeys, being really a kind of polecat. These are to be found in the Gandhala gorge and *Charronia flavigula* has appeared in a gorge near Rohtas

In his diary Mr. Wells, has described most of the places he visited thus :—

Jhelum.—There is a wide expanse of level plain prolonged into a narrower strip along the course of the river. It is the head-quarters of the district, and is near Rohtas, with its old fort.

Ara.—This and Ohoa Saidan Shah are on the edge of the range overlooking the Jhelum Valley. The plateau is very fertile, being one stretch of green fields as far as the eye can reach, with here and there a small group of barren nullahs. Plague was bad at Ara when Mr. Wells was in that neighbourhood and great care had to be taken especially about catching rats.

Chakri.—With Jalalpur was in barren country, but near the town were some fields of wheat and mustard and a few gardens watered from wells.

Gandhala.—Is in a broad valley and reserved forest, a well-wooded nullah, enclosed by ranges of hills up to 3,200′ in height.

On the trees at this part can be found traces of floods more than 13 ft. above the present level of the water.

Dalwal.—Here all the animals were trapped in hedges surrounding small irrigated gardens. Beyond these patches the country is barren. Crops are grown on alternate years.

Kallar Kahar.—This lake lies under the north slope of the Salt Range at altitude 2,100′. The surrounding country is quite barren, but round the edge of the lake are irrigated gardens with fruit trees. The lake is 3 miles in circumference and is about 4 ft. deep. The water is very salt so that most of the lake is open water, but there is a large area of marshy ground. Leeches swarm, though the water is so saline.

Sakesar.—Is the summer station for Shahpur, Attock and Mianwali districts. It is at 4,992′ altitude. The rainfall is 26′ and there is great water scarcity, all the drinking water fit for use having to be carried from the plain below.

Murree.—Also a hill station that suffers from water scarcity. The cost of transport in this area Mr. Wells found prohibitive.

Charihan.—(6,300′) is 6 miles south east of Murree, in reserved forest of *Pinus longifolia* and oak with little undergrowth.

Patriata.—(7,150′) also in reserved forest more mixed than at Charihan and with more undergrowth.

Banni.—(6,000′) is an area most unsuitable for small mammals as it has not a trace of cover.

This collection numbers 974 specimens which belong to 28 genera in 33 species :—

(1) MACACA MULATTA, Zimm.

The Indian Macaque.

(Synonymy in No. 7, under *M. rhesus* ? .)

Patriata (7,150′), ♂ 1, ♀ 1.

(2) LYRODERMA LYRA, Geoff.

The Indian Vampire Bat.

(Synonymy in No. 1.)

Lehtrar (3,000′), ♂ 11, ♀ 15 (11 Juv.)

(3) PIPISTRELLUS KUHLI LEPIDUS, Blyth.

The Kandahar Pipistrel.

(Synonymy in No. 24.)

Chakri (900′), ♂ 1.

(4) PIPISTRELLUS MIMUS, Wr.

The Common Dwarf Pipistrel.

(Synonymy in No. 1.)

Chakri ♂ 1, ♀ 4 ; Kallar Kahar (2,113′), ♂ 1, ♀ 1.

(5) SCOTOPHILUS KUHLI, Leach.

The Yellow Scotophil.

(Synonymy in No. 1.)

Chakri, ♂ 2, ♀ 3 ; Sanghoi (900′), ♂ 2, ♀ 8.

(6) LIPONYCTERIS KACHHENSIS, Thos.

The Cutch Sheath-tailed Bat.

1872. *Taphozous kachhensis*, Dobson, *P.A.S.B.*, p. 152.
1891. *Taphozous kachhensis*, Blanford, Mamm., No. 221.

1922. ***Liponycteris kachhensis***, Thomas, *A.M.N.H.*, ser. 9, vol. ix, p. 267, Jhelum, ♂ 1, ♀ 1 ; Rohtas (1,100′), ♂ 27, ♀ 37.

These were found in the old fort at Rohtas in an old circular domed room simply crammed with bats. There must have been hundreds of them and the noise of their quarrelling was deafening. The colour varies in both sexes from light chocolate brown on the back to dark brown, and from mustard yellow to brownish yellow beneath. As a rule the males are darker in general colour than the females. The tail projects through the upper half of the interfemoral membrane, the latter half being free. H.W.W.

(7) RHINOPOMA KINNEARI, Wr.

Kinnear's Mouse-tailed Bat.

(Synonymy in No 3.)

Sakesar (4,500′), ♂ 1, ♀ 3 ; Rohtas (1,100′), ♀ 42, unsexed 8, in alcohol 7.

' This genus occurs throughout the whole of the Salt Range at elevations from ' 1,000′ to 5,000′ wherever there are caves or old ruins, and are most frequently ' found in large numbers together. The general colour is light greyish to brown ' on the back, paler beneath. At present (June) there is little fat deposited ' round the foot of the tail. These bats when at rest have a habit of contract- ' ing their ears to about half the original size, making them appear quite ' different.' H.W.W.

(8) RHINOPOMA HARDWICKEI, Gray.

Hardwicke's Mouse-tailed Bat.

(Synonymy in No. 3.)

Sakesar, ♂ 6, ♀ 11 ; Rohtas, ♀ 3 ; Chitti Dil, ♂ 1, ♀ 3.

(9) PARAECHINUS BLANFORDI, And.

Anderson's Hedgehog.

Chakri, ♂ 6, ♀ 4 (1immature), 2 unsexed ; Candhal, ♂ 1 ; Ara ♂ 9, ♀ 4 ; Sakesar, ♀ 3 ; Rohtas, ♂ 1 ; Makhiala, ♂ 1.

This hedgehog has the division of the spines on the crown of the head, average length of spines being 35 mm. The colour of spines is blackish with two bands of white. The head is whitish mixed with black. Ears are large and covered with long white hairs. Most of the specimens have the under parts covered with long black hairs. This hedgehog is fairly common in the low tracts of the Salt Range along the river, and is generally found under piles of brushwood in thickset hedges and occasionally in houses where it evidently goes after beetles. They usually sleep at full length or half-curled, only rolling up tightly when frightened. When caught, one ♀ specimen made a peculiar noise exactly like a jungle cat that is wounded. H.W.W.

(10) PACHYURA sp.

Lehtar, ♂ 2, ♀ 2 ; Kohala (1,900′), ♂ 1 ; Patriata, ♂ 1 ; Pathankote, ♂ 1 ; Gandhala, ♀ 1 ; Kallar Khar, ♂ 8, ♀ 5.

(11) CROCIDURA RUBRICOSA, And.

Anderson's Assam Shrew.

(Synonymy in No. 25.)

Murree (7,030′), ♂ 6 ; Jalalpur, ♂ 1.

(12) FELIS ORNATA, Gray and Hardw.

The Desert Cat.

(Synonymy in No. 2.)

Rohtas (1,100′), ♂ 2 (1 juv.)

(13) FELIS BENGALENSIS, Kerr.

The Leopard Cat.

(Synonymy in No. 11.)

Kotli (5,800′), ♂ 1.

(14) HERPESTES AUROPUNCTATUES PALLIPS, Blyth.

The Small Sind Mongoose.

(Synonymy in No. 24.)

Chakri (900′), ♂ 2, ♀ 1.

'The fur of these creatures is close and short, the pattern very fine. They frequent hedgerows round gardens and wheatfields. The body of a hedgehog was used as bait to catch them. One specimen measured head and body, 270 ; tail, 220 ; hind foot, 48 ; ear, 24 ; weight, 11¾ ozs.' H.W.W.

(15) CANIS INDICUS, Hodgs.

The Jackal.

(Synonymy in No. 3.)

Pathankote (1,200′), ♂ 2 ; Dalwal (2,400′), ♂ 1.
Chakri, ♂ 1.

(16) VULPES LEUCOPUS, Blyth.

The Desert Fox.

(Synonymy in No. 3.)

Ara (2,100′–2,300′), ♂ 1, ♀ 2.

'These foxes frequent the scrub jungle rather than the cultivated areas and live on rats, mice, etc. The colouring is something similar to that of *V. montana* in summer pelage, but is not so well marked. The tails are very poor, being matted with burrs. The underneath parts have a decided pinkish tinge, owing no doubt to the nature of the soil where they have their burrows.' H W.W.

Vernacular name—'Lunbar' (Punjabi).

(17) VULPES MONTANA, Pearson.

The Hill Fox.

(Synonymy in No. 23.)

Kotli (5,800′), ♂ 1.

(18) PETAURISTA INORNATUS, Geoff.

The Large Red Flying Squirrel.

(Synonymy in No. 42.)

Lehtar (3,000′), ♂ 1 ; Murree (7,000′), ♂ 2.

(19) EOGLAUCOMYS FIMBRIATUS, Gray.

The Smaller Kashmir Flying Squirrel.

(Synonymy in No. 42.)

Bhurban (6,400′), ♂ 1.

(20) FUNUMBULUS PENNANTI ARGENTESCENS, Wr.

The Sind Banyan Squirrel.

(Synonymy in No. 24.)

Pathankote, ♂ 2, ♀ 1 ; Madhapur, ♂ 1 ; Rohtas, ♂ 1, ♀ 2.
Chakri, ♂ 1, ♀ 1 ; Ara, ♂ 3, ♀ 3 ; Choah Saidan Shah, ♂ 1.
Kallar Kahar, ♂ 11, ♀ 2 ; Sodhi (4,900′), ♀ 2.

(21) GERBILLUS GLEADOWI, Murray.

The Sind Gerbil.

(Synonymy in No. 12.)

Chakri, ♀ 1.

(22) DIPODILLUS INDUS, Thos.

The Little Sind Gerbil.

1920. *Dipodillus indus*. Thomas, *J.B.N.H.S.*, vol.xxvi, p. 935.
Chakri, ♀ 1, juv.; Rohtas, ♂ 1, ♀ 2.

(23) TATERA INDICA, Hardw.

The Indian Gerbil.

(Synonymy in No. 1.)

Madhapur, ♂ 8, ♀ 3 ; Rohtas, ♂ 10, ♀ 9 ; Ara, ♂ 9, ♀ 9 ; Mogli (1,002′), ♂ 7, ♀ 4 ; Chakri, ♂ 18, ♀ 29 ; Gandhala, ♂ 12, ♀ 5 ; Dalwal, ♀ 3 ; Kallar Kahar, ♂ 1, ♀ 2 ; Sakesar (4,500′), ♂ 3, ♀ 6.

(24) APODEMUS SYLVATICUS GRISENS, True.

The Long-tailed Field Mouse.

(Synonymy in No. 15.)

Murree (7,000′), ♂ 25, ♀ 10.

(25) GOLUNDA ELLIOTI MYOTHRIX, Hodgs.

The Northern Golundi.

1845. *Mus myothrix*, Hodgs., *A.M.N.H.*, vol. xv, p. 267.
1923. *Golunda ellioti myothrix*, Thomas, *J.B.N.H.S.*, vol. xxix, p. 376.

Gandhala, ♂ 3, ♀ 1 ; Dalwal, ♀ 2 ; Sakesar, ♂ 3, ♀ 2, in alcohol 1.

(26) MILLARDIA MELTADA, Gray.

The Soft-furred Field Rat.

(Synonymy in No. 1.)

Pathankote, ♂ 6 ; in alcohol 1.

(27) MUS GERBILLINUS, Blyth.

The Sind Wild Mouse.

(Synonymy in No. 24 under *M. bactrianus.*)

Pathankote, ♂ 1, ♀ 1 ; Rohtas, ♂ 5, ♀ 4 ; Mogli, ♂ 7, ♀ 3.

Chakri, ♂ 18, ♀ 13 ; Jalalpur, ♂ 1, ♀ 1 ; Ara, ♂ 31, ♀ 31 ; in alcohol 1; Chaoh, ♂ 2 ; Gandhala, ♂ 2 ; Dalwal, ♂ 1, ♀ 1 ; Kallar Kahar, ♂ 26, ♀ 28 ; Pail, ♀ 3 ; Sakesar, ♂ 8, ♀ 4, 1 sexed ; Jhelum, ♂ 3, ♀ 4 ; Lehtrar, ♂ 14, ♀ 5 ; Sambli, ♂ 1, ♀ 3 ; Banni (6,000′), ♂ 2 ; Patriata (7,150′), ♂ 1.

(28) NESOKIA GRIFFITHI, Hardw.

The Mountain Mole-rat.

(Synonymy in No. 15.)

Chakri, ♀ 1, juv.; Ara, ♀ 1 ; Gandhala, ♂ 1, ♀ 1.

Kallar Kahar, ♂ 4, ♀ 9.

The young of *Nesokia* are very much darker in the fur than the adults, Mammæ are 2–2=8.

(29) RATTUS RATTUS RUFESCENS, Gray.

The Indian House Rat.

(Synonymy in No. 1.)

Pathankote, ♂ 1 ; Madhapur, ♀ 1 ; Chakri, ♀ 1 ; Ara, ♂ 1, ♀ 2 ; Choah S. Shah, ♂ 1 ; Sakesar, ♀ 1.

(30) RATTUS VICEREX, Bonh.

The Central Asian Rat.

(Synonymy in No. 15.)

Charihan (6,300′), ♂ 3, ♀ 5 (1 juv.) ; Banni, ♀ 2 (juv.) ; Patriata, ♂ 7, ♀ 10 (10 juv.) ; Kotli, ♂ 1 ; Lehtar, ♂ 8, ♀ 4.

Sambli Beramal, ♂ 2, ♀ 2 ; Bhurban, ♂ 15, ♀ 13 (10 juv.)

Murree, ♂ 14, ♀ 17 (7 juv.)

Rohtas, ♀ 1 ; Ara, ♂ 5, ♀ 1, in alcohol 1 ; Sodhi, ♂ 1 ; Choah S. Shah, ♂ 1, ♀ 2 ; Gandhala, ♂ 18, ♀ 10 ; Kallar Kahar, ♂ 3 ; Sakesar, ♂ 3, ♀ 5, in alcohol 1

(31) MICROTUS (HYPERACRIUS) WYNNEI, Blanf.

The Murree Vole.

1880. *Arvicola wynnei*, Blanford, *J.A.S.B.*, vol. xlix, pt. 2, p. 244.
1889. *Microtns wynnei*, Blanford, Mamm., No. 303.

Murree, ♂ 13, ♀ 10 ; 2 unsexed ; in alcohol 3.

(32) LEPUS DAYANUS, Blanf.

The Sind Hare.

(Synonymy in No. 2.)

Rohtas, ♀ 2 (1 juv.); Nurpur, ♀ 2; Ara, ♂ 1; Gandhala, ♀ 1; Lehtar, ♂ 1, ♀ 1; Murree, ♂ 1; Sambli, ♂ 1 (juv.).

'This hare is a sandy brown colour on the back mixed with black; under fur whitish, sides paler with a tinge or fulvous; fur beneath pure white except on the throat where it is brown. Chin is white. Tail dark brown above, white below. Ears very thinly clad with short brown hair, outer edges trimmed with whitish fur.' H.W.W.

(33) GAZELLA BENNETTII, Sykes.

The Indian Gazelle.

(Synonymy in No. 1.)

Ara, ♀ 2.

They are said to breed twice during the year, in April–May and October-November. Bucks and does are always seen together, and the former seem if anything the more numerous, a point in which they differ from the *Ovis vignei.*

SUPPLEMENT TO REPORT NO. 23.

A SMALL COLLECTION OF MAMMALS MADE BY COL. F. M. BAILEY

This collection was made over by Col. Bailey to Mr. H. W. Wells in 1922 at the time of the Kangra and Chamba work. As the places from which the specimens were obtained are for the most part near Sikkim and Bhutan it seems better to class the collection with those from the East Himalayas.

(1) MYOTIS MOUPINENSIS, A.M. Edw.

Milne-Edward's Mouse-eared Bat.

1872. *Vespertilio moupinensis*, Mylne-Edwards, Rech. Mamm., p. 253.
Tsamba—Bhutan, 1 unsexed.

(2) PACHYURA SATURATIOR, HODGS.

The Brown Musk Shrew.

1855. *Sorex saturatior*, Hodgson, *A.M.N.H.*, 2, vol. xvi, p. 110.
Gangtok, Sikkim—1 unsexed.

(3) EUPETAURUS CINEREUS, Thos.

The Woolly Flying Squirrel.

1888. *Eupetaurus cinereus*, Thomas, *J.A.S.B.I.*, vol. vii, pt. 2, p. 258.
Gyantse Bazaar—Tibet, 1 unsexed.
Dried skin purchased.

(4) MARMOTA LITTLEDALEI, Thos.

Littledale's Marmot.

1909. *Arctomys littledalei*, Thomas, *A.M.N.H.*, ser. 8, vol. iii, p. 259.
Paik, Tagdumbash Pamirs (13,000′), 1 unsexed.
Yelpak Tash, Chinese Turkistan (11,000′), 1 unsexed.

(5) RATTUS NITIDUS, Hods.

The Nepal Shiny Rat.

(Synonymy in No. 15.)

Bumtang, Bhutan (9,000′), ♂ 2.

(6) RATTUS RATTUS SIKKIMENSIS, Hint.

The Common Sikkim Rat.

1918. *Rattus rattus sikkimensis*, Hinton, J.B.N.H.S., xxvi, pp. 59, 384.
Ganetok, Sikkim, 1 unsexed.

(7) Lepus oiostolus, Hodgs.

The Woolly Hare.

1840. *Lepus oistolus,* Hodgson, *J.A.S.B.*, vol. ix, p. 1186.
1899 ,, Blanford, Mamm. No. 324.
Long To, Tibet (15,000′), ♂ 1.

(8) Ochotona roylei, Ogil.

The Himalayan Mouse-Hare.

(Synonymy in No. 15.)

Che Lang La, Tibet (14,500′), ♀ 1.
Sang Trongo, Tibet (14,000′), 1 unsexed.
Gyantse, Tibet, ♂ 1.

(9) Ochotona wollastoni, Thos.

The Mount Everest Mouse-Hare.

1922. *Ochotona wollastoni*, Thomas, *A.M.N.H.*, ser. 9, vol. ix, p. 184.
Long To, Tibet (15,000′), 1 unsexed.

(10) Nectogale sikkimensis, de Wint.

The Sikkim Water-Shrew.

(Synonymy in No. 23.)

Sikkim, 1 unsexed ; Punaka, Bhutan (5,000′), 1 unsexed.

(11) Mustela temon, Hodgs.

The Pale Weasel.

(Synonymy in No. 44.)

Tuwa, Tibet (12,000′), ♂ 1

Supplement to Report No. 31.

ON A COLLECTION OF SPECIMENS FROM THE NILIGIRIS, No. 31-A.

By Mrs. Helen M. Lindsay, m.a., b.sc.

This collection of 95 specimens made by the late Mr. J. Riley O'Brien in the months of June and July, 1921, follows closely the earlier Report No. 31, but there are five species in it which find no representative in that collection. These are *Rhinolophus rouxi*, *Ratufa indica bengalensis*, *Funambulus palmarum comorinus*, *Tatera cuvieri*, *Manis crassicaudatus*.

Though the Gazetteer mentions the Nilgiri Ibex as peculiar to the Nilgiri District, no specimen of it has yet been received from this area. No diary of the collecting tour has been found, so any notes on the habits of the creatures is impossible.

The specimens belong to 11 genera in 15 species, as follows :—

(1) Rhinolophus rouxi, Temm.

The Rufous Horse-shoe Bat.

(Synonymy in No. 5)

Benhope (3,000–4,000′), ♂ 6, ♀ 2.

(2) Viverricula malaccensis, Gmel.

The Small Indian Civet.

(Synonymy in No. 3)

Benhope (3,000′), ♂ 1, ♀ 1.

(3) Herpestes edwardsi carnaticus, Wroughton.

The Common Carnatic Mongoose.

(Synonmy in No. 22, under *Mungos mungo ellioti*. See also Results, *J.B.N H S.*, vol. xxviii No 1 of 1921.)

Massingudi (3,500′) ♂ 1, ♀ 1.

(4) CANIS NARIA, Wroughton.
The South Indian Jackal.
(Synonymy in No. 1 under *aureus.*)

Massingudi (3,500′), ♂ 1.

(5) PETAURISTA PHILIPPENSIS, Elliot.
The South Indian Flying Squirrel.

Benhope (3,000′-4,000′), ♂ 3, ♀ 2.

(6) RATUFA INDICA BENGALENSIS, Blanf.
The Central Indian Giant Squirrel.
(Synonymy in No. 7.)

Massingudi (3,500′), ♂ 1, ♀ 1.

(7) FUNAMBULUS GOSSEI, Wroughton.
Gosse's Squirrel.

Benhope (3,000′-4,000′), ♂ 4, ♀ 3.

(8) FUNAMBULUS PALMARUM COMORINUS, Wroughton.
The Travancore Palm Squirrel.
(Synonymy in No. 34.)

Benhope (3,000′-4,000′), ♂ 10, ♀ 9.

(9) FUNAMBULUS SUBLINEATUS, Wroughton.
The Dusky Striped Squirrel.
(Synonymy in No. 11.)

Benhope (3,000′-4,000′), ♂ 4, ♀ 1.

(10) TATERA CUVIERI, Waterh.
The Madura Antelope Rat.

Massingudi (3,600′), ♂ 10, ♀ 7.

(11) RATTUS BLANFORDI, Thos.
The White-tailed Rat.
(Synonymy in No. 2.)

Benhope ♂ 1. Massingudi, ♂ 1, ♀ 2.

(12) RATTUS RATTUS RUFESCENS, Gray.
The Common Indian Rat.
(Synonymy in No. 1.)

Mettapallaiyam (1,200′), ♂ 3, ♀ 1.

(13) RATTUS RATTUS WROUGHTONI, Hint
The Nilgiri Tree Rat.
(Synonymy in No. 33.)

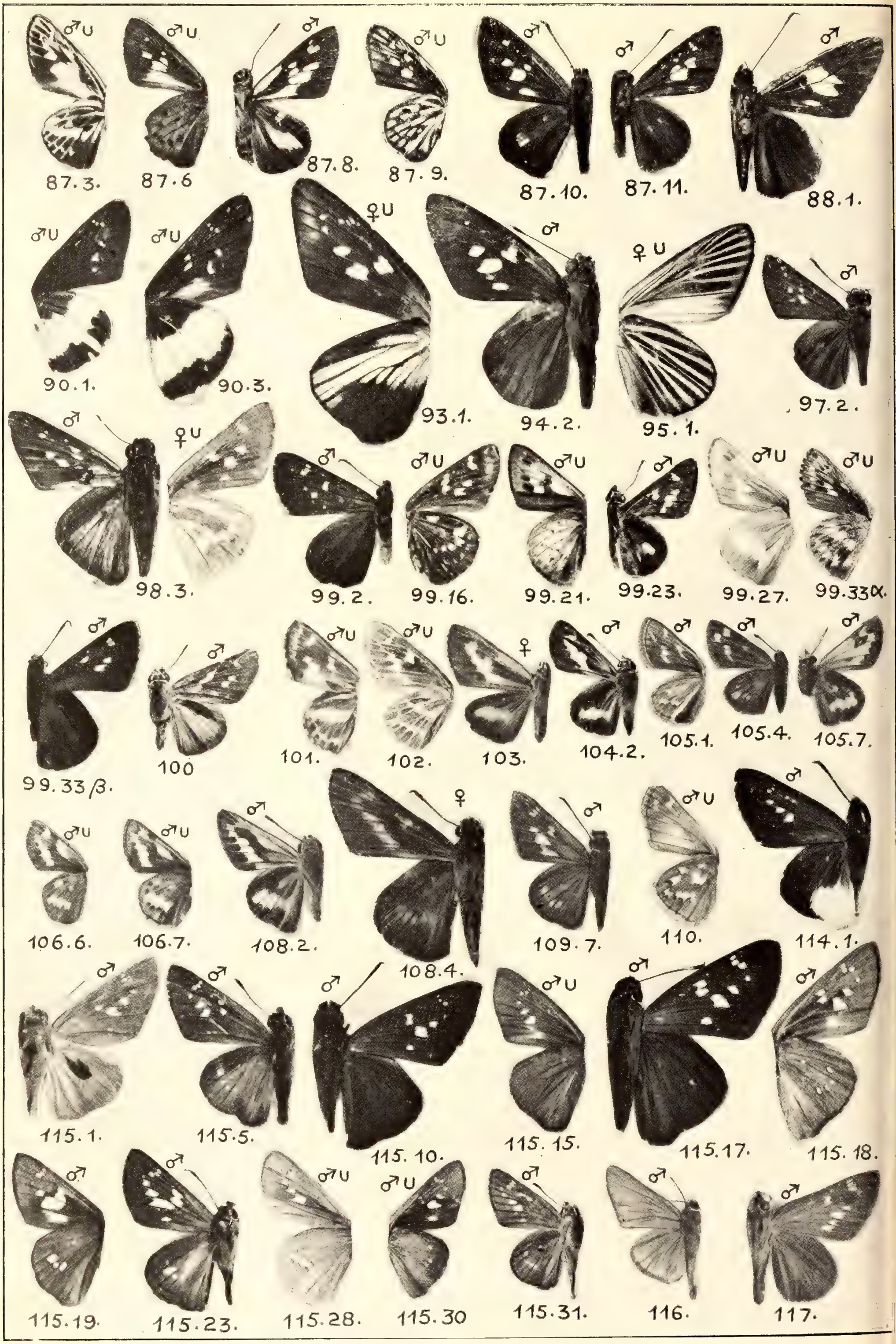
Benhope (3,000′-4,000′), ♂ 8, ♀ 7; Massingudi, ♂ 4, ♀ 1.

(14) LEPUS NIGRICOLLIS, F. Cuvier.
The Black-naped Hare.
(Synonymy in No. 5.)

Massingudi, ♂ 1.

(15) MANIS CRASSICAUDATUS, G. St. Hailaire.
The Indian Pangolin.
(Synonymy in No. 3.)

Massingudi, ♂ 1.


♂ U
87.3.
♂ U
87.6
♂
87.8.
♂ U
87.9.
♂
87.10.
♂
87.11.
♂
88.1.
♂ U
90.1.
♂ U
90.3.
♀ U
93.1.
♂
94.2.
♀ U
95.1.
♂
97.2.
♂
♀ U
98.3.
♂
99.2.
♂ U
99.16.
♂ U
99.21.
♂
99.23.
♂ U
99.27.
♂ U
99.33α.
♂
99.33β.
♂
100
♂ U
101.
♂ U
102.
♀
103.
♂
104.2.
♂
105.1.
♂
105.4.
♂
105.7.
♂ U
106.6.
♂ U
106.7.
♂
108.2.
♀
108.4.
♂
109.7.
♂ U
110.
♂
114.1.
♂
115.1.
♂
115.5.
♂
115.10.
♂ U
115.15.
♂
115.17.
♂
115.18.
♂
115.19.
♂
115.23.
♂ U
115.28.
♂ U
115.30
♂
115.31.
♂
116.
♂
117.

I. **Hesperiidæ.** *Pamphilinæ* (Part).

THE IDENTIFICATION OF INDIAN BUTTERFLIES

BY

COL. W. H. EVANS, D.S.O., F.Z S., F.E.S.

(*Continued from page 446 of this Volume*)

Part XI

(*With a Plate*)

I. 89. **Zela.** The Redeye Palmers.

Above dark brown with white or pale yellow hyaline spots on F. Uph unmarked, cilia yellow, broadly so at tornus.

1 (2) ♂ upf with a broken black seam from mid v1 to just after base 3, where it meets a small glandular patch at base 3, angled at v2 ; uph disc clothed long hairs. Upf single lower cell spot in ♂, double in ♀, oblique spot mid 2, spot in 3 and apical in 6. Unf dark brown, costa overlaid dark ochreous scales and dorsum in ♀ pale brown, in ♂ overlaid centrally pale ochreous scales. Unh chestnut brown, basally paler, a pale yellow spot end cell.

α. Larger. Upf and unf outwardly conspicuously paler.

zeus optimus, Fruh. (46–47). The Redeye Palmer. Assam. Tavoy. VR.

β. Smaller. Upf and unf not paler outwardly. Unf unmarked.

zeus zeus, DeN. (44–46). Sumatra, Pulo Laut, Borneo, Mindoro.

2 (1) ♂ upf no brand ; uph a conspicuous tuft of brown hairs from near base cell overlying cell ; the cell H unusually short=$\frac{1}{4}$ wing and lower angle bent up at origin of v3 at right angles to v6, v4 arising half-way between, no trace of v5, v2 opposite v8 ; F dorsum bowed ; unf dorsum and uph costa polished. Above brown, white hyaline spot near base 3 and a narrow irregular spot below it in 2. Below paler, dcv F and H marked pale yellow and apex F paler.

zenon, DeN. (45–47). The Tufted Redeye Palmer. Borneo, Pulo Laut. VR.

I. 90. **Acerbas.** The White Palmers. (Plate 32.)

Above dark down with white hyaline spots F and a white central band H ; F comparatively small spots in 2 and 3 and apical in 6–8, no spot in 1. H lobed and excavated at v1 and tornal cilia white. Unh broad white central band continuous from mid dorsum to costa before apex.

1 (2*a*) Unh white band connected broadly to dorsum in space 3. Upf no cell spot and unf no spot in 1. Uph white band to v4. Unh white band silvery. Body white below, dark brown above.

* *anthea*, Hew. (30–43). The white Palmer. Dawnas to S. Burma, Siam, Malay Peninsular, and Islands. (=*tagiadoides*, Fruh, *ciliatus*, But). R.

2*a* (1) Unh white band not connected to termen.

2 (3) Unf single upper spot in cell immediately over the spot in 2. Unh band dull white. Uph white band to v6. Unf large white spot in 1 in ♀. Body whitish above, striped below.

α. Uph white band illdefined anteriorly. Below no purple wash. Unh white band uniform, contracted at costa.

duris martini, Dist. (38–48). The Dull White Palmer. Borneo, Pulo Laut, Sumatra. R.

β. Uph white band sharply defined. Below purple wash over the dark areas, especially at apex F. Unh white band yellow in 7 and 8, not contracted at costa.

duris duris, Mab. Philippines. R. (= *mabillei*, Stg).

3 (2) Upf 2 spots in cell well behind the spot in 2. Unh band glistening white, very broad. Uph ♂ white band only to v1, thence obscurely whitish to v4 ; in ♀ white band to v4. Body white above and below. Unf mid dorsum whitish.

* *nitidifasciata*, Elwes. (48–50). The Silver Palmer. Dawnas to S. Burma, Selangor, Borneo, Labuan. R.

†(*albimedia*, Joicey and Talbot is a very distinct species from Dutch New Guinea).

I. 91. Zea. The Silver and Yellow Palmer.

Above dark brown. Upf prominent yellow separate hyaline spots ; across cell from origin of v3 ; in 2¼ along v2, in 3⅓ along v3. Uph costa before apex whitish. Unh dark brown with a very broad silver band from mid v1 to costa behind apex, 5 mm. wide.

mytheca, Hew. (48). Victoria Point, S. Burma, Malay Peninsular, Sumatra and Borneo. VR.

I. 92. Eetion. The Whitespot Palmer.

Above dark brown with hyaline spots F and H ; upf with an upper cell spot, large spot in 2 vertically below it, small spots in 1, 3 and 4, apical dots in 6–8 and sometimes 2 dots in 5. Uph a transverse row of hyaline white spots separated by veins in 1–4 ; dorsum dull whitish. Unh basal area to v8 shining white from the base to the discal spots.

elia, Hew. (50). S. Mergui, VR. Malay Peninsular, Sumatra, Borneo. (=*eburus*, Plotz ; *ayankara* and *magniplaga*, Fruh.)

I. 93. Unkana. The Hoary Palmer. (Plate 32.)

1 (2) Above ♂ dark brown, ♀ black. Upf large hyaline spots, pale yellow in ♂ and white in ♀ ; in cell behind origin of v3, in 3⅓ along v4 and in 2 midway between ; subapical spots in 4 and 5 near margin and apical in 6–8. Uph plain in ♂, in ♀ lower discal area to base and dorsum white. Unf ♂ apex broadly paler, veins black, some purple white scales and violet washed ; in ♀ large whitish suffused spots before termen in 3, 4 and 5. Unh in ♂ dark brown with obscure purple wash, veins black, whitish central area extending to base 7, obscurely paler between veins near termen ; ♀ with a broad transverse white area crossed by black veins from base to below apex.

* *attina*, Hew. (64–72). The Hoary Palmer. Bassein to S. Burma, Malay Peninsular and Islands. NR. (=*batara*, Dist.; *latreillei*, Fd.; *cruda*, HS.; *anitta*, Plotz. The Philippine race is *mabillei*, Stg.=*palawana* and *mindanensis*, Fruh.)

2 (1) Above dark brown with large conjoined bright yellow hyaline spots on F, forming a broad central band from 1–3 and cell, apical spots in 6–7. Unf lower part of spot in 1 whitish and unh margin broadly paler.

harmachis, Hew. (53–55). The Orange Palmer Malay Peninsular, Sumatra, Banka. VR (=*staudingeri*, Dist.)

I 94. Hidari. The Palmers. (Plate 32.)

1 (2*a*). Upf with large conjoined hyaline yellow spots as in *harmachis*, no apical spots. ♂ upf a seam from mid 1 to base 4. Unf apex grey powdered and unh 2 grey bands as in *Gangara thyrsis*. Antennæ yellow banded below club.

ozias, Hew. (54). The Javan Palmer, Java. VR.

2a (1) Upf hyaline spots on F pale yellow, well separated ; spot across cell, in 2, 3, semi-hyaline spot in 1 against v1, apical spot in 6 only. No ♂ brand.

2 (3.4). Upf spot in cell with its centre against the origin of v3 ; spot in cell ¼ along v4 ; spot in 2 not reaching origin of v3, well separated from cell spot, its inner edge in line with the centre or outer edge of the cell spot. Below dark brown, costa and apex F and all H pale brown with a faint purple wash ; some rather obscure small dark spots about apex F and discal spots in 1–6 on H as well as a pale yellow spot unh in cell under the origin of v7.

* *irava*, M. (54–58). The Greasy Palmer. Burma, Malay Peninsular and Islands. NR. (=*hypoepa*, Hew ; *thrax*, Hub in errore).

3 (2-4). Above as *irava*. Below pale yellow, unh evenly striated, a brown streak near costa and near dorsum.

bhawani, DeN. (56). The Veined Palmer. Arracan Coast. VR.

4 (2.3). Upf discal spot in 2 shifted in to the origin of v3, joining cell spot. Unh spot in cell white, smaller. Spot in 1 F more upright and diffused below. Below darker, dark spots obscure or absent.

doesoena, Martin. (55–58). The Sumatran Palmer. Sumatra. VR.

I. 95. Pirdana. The Green Palmers. (Plate 32.)

Above unmarked, no hyaline spots.

1a (3). Antennæ plain black. ♂ above dark brown ; ♀ with basal ½ F and ¾ H dark metallic green.

I. 95. Pirdana.—(*contd.*)

1 (2). Below dark brown, veins broadly green on costa and apex F and all H ; dorsum F pale brown in ♂ whitish in ♀. Uph tornus narrowly orange in ♂, broadly so in ♀.

* *hyela*, Hew. (40–55). The Green striped Palmer, Assam to Burma. R. S. China, Hainan, Siam, Malay Peninsular and Islands, Palawan. (=*rudolphii*, El. and DeN.; *scanda*, Fruh.)

2 (1). Below uniform rather dull dark green, unstriped, dorsum F pale and space 1 F and H purple. Uph tornus narrowly orange.

distanti, Stg. (50). The Plain Green Palmer. Karens to S. Burma, R. Malay Peninsular, Sumatra, Nias, Borneo and Java (=*niasica*, Fruh ; *pavona*, DeN. *ismene*, Fd. = *sargon*, Mab. is an allied species with a dark green underside and pale veins from the Celebes).

3 (1a.) Antennæ shaft white above to base club and club white banded before apiculus. ♂ above dark brown, bases shining metallic green, elsewhere purple washed. Below as *distanti*. Uph tornal orange area broad, reaching v4.

albicornis, El. (50). The Albicorn Green Palmer. Borneo. VR. (Allied species are—*tiacellia*, Hew, Aru and New Guinea—*albidiscus*, Joicey and Talbot, Schouten Is. New Guinea).

I. 96. Creteus. The Nonsuch Palmer.

Above very dark brown, ochreous hairs at bases and on body and dorsum F ; small pale yellow white hyaline spots F and H. Upf 2 spots in cell, spots in 1, 2, 3 and apical 6–8 uph spot in cell, 2, 3, 6 and mid 7, tornal cilia broad yellow terminal border from dorsum to v3 ; unh terminal yellow border from tornus to just above 4 and angled inwards in 2. ♀ spots above larger.

a. Unh yellow border comparatively narrow.

cyrina parca, DeN. (46–48). Assam. VR.

β. Unh yellow border considerably broader.

cyrina cyrina, Hew. Borneo. (= *meleagrina*, Stg.).

I. 97. Gehenna. The Swollen Aces. (Plate 32.)

Above dark brown with pale yellow spots on F ; 2 small spots in cell (upper may be absent or minute), oblique narrow spot in 2 immediately under cell spot, small spot in 2, 3 and apical spot in 6. In ♀ spots are larger, spot in 2 is quadrate, small spots in 4 and 7 and non-hyaline spot in 1. Unf dorsum outer half white in ♀.

1 (2). Unh unmarked. Below dark brown, costa F and all H overlaid sparse yellow scales. H scv. and v8 hair-pinwise.

greæ, DeN. (35). The Plain Swollen Ace. Malay Peninsular (Bukit Tanga), Sumatra. VR.

2 (1). Unh marked with a series of small, dark discal spots. H v8 and scv normal.

α. Below costa and apex F and all H overlaid ocherous green scales, leaving on H very obscure dark discal spots in 1–6 and cell; in ♀ the spot in 2 is white. ♂ uph greenish hairs on disc.

* *abima dawna*, **nov.** (35). The Spotted Swollen Ace. Dawnas to Mergui. VR.

β. Below clothed greyish yellow scales ; unh with prominent dark discal spots in 1–6 increasing in size posteriorly and a spot in cell.

abima angulifera, El. Mindoro. VR.

γ. Upf cell spots conjoined and above clothed ochreous hairs ; unh with 5 ill-defined brown spots.

abima abima, Hew. Macassar. Celebes.

I. 98. Pithauria. The Straw Aces. (Plate 32.)

Above dark brown ; pale yellow (♀ white) spots on F, double in cell, mid 2 in 3 and apical 6–7 (rarely 8) ; the spots in the ♂ of the first 2 species may be much reduced or entirely absent, especially those in the cell, but are prominent below.

1a (3). Unh no prominent pale spots and no brand in ♂.

1 (2). ♂ base and dorsum upf and all H except for the broad and dark border clothed straw coloured hairs, dense on H. Unf area mid dorsum to cell and v2 pale yellow. Below brown, apex and costa F and all H clothed greyish ochreous scales ; obscure indications of spots unh,

I. 98. Pithauria.—(*contd.*)

straumineipennis, WM. (44–50). The Light Straw Ace. Sikkim to Burma (Tavoy), W. China, Malay Peninsula, Borneo, Sumatra. NR.

2 (1). ♂ darker, clothing of greenish hairs above and ochreous scales below. Unf no pale area mid dorsum ; unh pattern not quite so obscure.

murdava, M. (36–50). The Dark Straw Ace. Sikkim to Burma. Malay Peninsula, Borneo. NR.

3 (1a). ♂ with brand upf. Above ♂ base and dorsum F and all H except costa clothed greenish hairs. Below dark brown costa and apex F and all H closely overlaid golden ochreous scales ; unh small pale yellow spots in 2, 3, 6 and base 7 ; may be dots in 4, 5 and 1. ♀ unf small white spot in 1 against v1 and tornal spot in 1 ; unh chestnut brown with large silvery white conjoined discal spots in 1–5, where it joins a broad silver streak reaching to base 6, above which there is another silver streak filling most of 7, also a silver spot in 1 under cell the markings unh are very variable and sometimes the spots are as small as in the ♂.

* *marsena*, Hew. (44–50). The Branded Straw Ace. Assam to Burma, Malay Peninsular, Tonkin, Sumatra, Nias, Java and Borneo. NR. (= *aitchisoni*, WM. and DeN. ; *glauca*, Stg. ; *uma*, DeN. ; *ornata*, Fd. ; *subornata*, Ploz.). (The ♀♀ of these 3 species appear to be extremely rare).

I. 99. Halpe. The Aces. (Plate 32.)

Above dark brown ; upf normally 2 cell spots, 2 discal (2 and 3), 3 apical (6–8) ; cell spots may be conjoined or one or both may be absent and the apical spot in 8 is often absent (*hieron* is spotless). ♀ usually has a non-hyaline spot in 1 (present in ♂ *masoni*) ; spots white to golden. Uph unspotted (except *submacula*), but there may be a yellow patch on the disc (*decorata*, *honorei* and *masoni*) or more usually dull ochreous hairs. Below dark brown, costa and apex unf and all unh overlaid differently coloured scales ; unf apex may be spotted ; unh may be plain, marked with dark or pale spots or with a pattern. The ♂ brand is missing in *honorei*, *masoni*, *astigmata* and *hieron* ; it may be just a seam from v1 to base 3 or consist of 2 whitish pouches, v1 may be distorted and v2 bent up.

1a (27a). Upf (or at any rate unf) either 2 cell spots present or upper one is absent (individuals of *gupta* and the ♂ of *decorata* are aberrant).

1b (5a). Upf cell spots immediately over the spot in 2. Unf mid dorsum pale.

Separata Group.

1c (3a). Unh and apex unf unmarked, clothed dense dark ochreous scales. Upf cell spots conjoined.

1 (2). Above cilia prominently white, chequered brown at ends of veins. Unh olive ochreous.

separata, M. (35–37). The Chequered Ace. Kumaon to Manipur. R.

2 (1). Above cilia brown, very obscurely chequered. Unh dark ochreous.

* *grahami*, **nov.** (33–36). Graham's Ace. Assam, Manipur. R.

9a (1c). Unh marked.

3 (4). Unh yellow, small black discal spots in 2, 3 and 7, upf cell spots usually conjoined.

subflava, Leech. (29–32). The Chinese Yellow Ace. W. China.

4 (3). Unh dark purple brown, with an irregular white basal area, extending to centre of wing. F cell spots separate.

hyrtacus, DeN. (32–36). The White-banded Ace. Coorg, N. Kanara. VR.

5a (1b). Upf cell spots well behind the spot in 2.

5 (6a). Unh veins conspicuously pale ; chequered irregularly with dark brown spots on a whitish ground, discal spot in 4–5 being very large. Palpi white below. F cell spots separate. Unf whitish streak mid dorsum.

Albipectus Group.

albipectus, DeN. (28–30). The Silverbreast Ace. N. Shan States to S. Burma. NR.

6a (5). Unh veins never pale.

6b (19a. 26). Unh unmarked or with pale streaks or spots ; not with dark spots nor with a pale continuous band.

6c (14a). Cilia not chequered at ends veins uph.

I. 99. Halpe.—(*contd.*)

Varia Group.

6a (9a. 13). Cilia uph bright ochreous throughout. ♂ upf brand consists of 2 whitish pouches.

6 (7. 8). Unh unmarked, overlaid greenish ochreous scales. Upf spots yellow, cell spot double.

aina, DeN. (36–38). The Garhwal Ace. Garhwal to Assam. R.

7 (6. 8). Unh densely overlaid ochreous brown scales ; silver dash in 2, long streak in 3, obscure spot in 4, very long streak in 6. Unf apex with submarginal yellow spots. Upf spots prominent, cell spot double.

bivitta, Ob. (33). The Silverstreak Ace. W. China, E. Thibet. R. (=*albivitta*, Ob.).

8 (6. 7). Unh ferruginous brown, very small white discal spots in 2 and 3, obscure spot in 6 and 2 small spots in 1. Upf spots small, cell spots separate.

sitala, DeN. (37). The Tamil Ace. Nilgiris and Animalais. VR.

9a (6d. 13). Uph cilia white or very pale yellowish.

9b (11a). Unh whitish discal spots in 2, 3 and 6 ; overlaid greenish ochreous scales. Upf spots white.

9 (10). Unh veins not dark ; spots obscure. ♂ brand as in *sitala* group. Upf spots may be absent, but show unf.

gupta, DeN. (36–40). The Olive Ace. Garhwal to N. Burma (Bernardmyo), W. China. R. (=*caenis*, Leech and *fusca*, Elwes).

10 (9). Unh veins prominently black ; spots very prominent. Upf upper cell spot often absent.

varia, Murray. (34). The Japanese Ace. Japan. NR.

11a. (9b). Unh marked with more spots than in 2, 3 and 6. Upf cell spots usually conjoined.

11 (12). Of small size with rounded wings. Unh overlaid ochreous brown scales ; very obscure series of discal yellow spots in 2, 3 and 6 and a postdiscal series in 1–5. F v2 much bent up at origin. Palpi more porrect.

blanchardi, Mab. (30). Blanchard's Ace. W. China.

12 (11). Larger, wings more pointed. Unh greenish ochreous, obscure whitish spots in 2, 3 and 6 and a pale subterminal macular band (described thus but figure shows a continuous discal row of yellow spots 1–6 and no subterminal band).

debilis, El. (34). Elwes' Ace. Assam (Tring. Mus.). VR. (I have not been able to recognize this species. ?=*baileyi*, South S. E. Thibet, unh reddish ochreous brown, with a post median series of yellow spots in 3–7).

13 (6d. 9a). Uph cilia cinereous. Unh and apex unf overlaid very dense ochreous scales ; unf pale yellow submarginal streaks at apex ; unh obscure yellow discal dashes in 2, 3, 6 and 7 as well as an obscure series of submarginal dashes in 1–6. Upf spots pale yellow, cell spots separate.

thandaunga, **nov.** (38–41). The Thandaung Ace. Karen Hills, 2 ♂♂ in April 1914. Resembles a *Pithauria*.

14a (6c). Uph cilia prominently chequered. Upf cell spot usually double.

Cerata Group.

14b (18). Unh with more than one pale spot or streak.

14 (15a). Unh no spot base 7 ; ochreous brown with whitish discal streaks in 2, 3, 5 and 6 and silvery streaks in 1, 2 and 3. Upf cell spots separate. Unf no pale marking in 1.

latris, Leech. (35). Leech's Ace. W. China. VR. (=*perbella*, Hering, China, upf lower cell spot elongated towards base, unh 2 long pale streaks from base, some discal and submarginal markings or pale streaks, 29 mm).

15a (14). Unh more or less prominent pale spot base 7. Unf a pale marking in 1 and submarginal spots at apex.

15b (17). Unh very dark brown, markings white. Unf pale streak in 1 nearly reaching to termen.

15b (17). Unh markings consist of small dots and are very variable ; the series is discal spots in 2-6 and 2 spots in 6 also an obscure submarginal series. ♂ no brand.

astigmata, Swin. (35–40). The Southern Spotted Ace. Coorg, N. Kanara. N.R.

I. 99. Halpe.—(*contd.*)

16 (15). Unh markings larger and more constant, similar, but only a single large spot in base 7 in addition to the submarginal spots. ♂ with brand. Uph white spots in 2, 3 and 4 show through obscurely from below.

**cerata*, Hew. (35–40). The Northern Spotted Ace. Sikkim to Karens. NR.

17 (15b). Unh ochreous brown with very large numerous yellow markings; discal and submarginal markings conjoined in 4–5, cell yellow and large spot beyond, also a double basal streak in 1. Unf short pale dash mid 1 against v1. Uph prominent whitish hyaline spots in 2, 3 and 6. Wings produced.

submacula, Leech (42). The Chinese Spotted Ace. China (Chang Yang), Tonkin, Formosa.

18 (14b). Unh bright ochreous brown, single white spot in 6 and very obscure traces of darker diffused discal markings. Unf traces of a submarginal apical fascia and a very small spot in 1 against v1. Uph cilia cinereous, chequering rather obscure.

hyrie, DeN. (32–37). DeNicéville's Ace. Sikkim to Shan States. R. (I have a ♂ from S.E. Thibet which has a plain underside and the cilia are unchequered).

19a (6b). Unh with dark spots.

19b (24a). Uph cilia not white.

Masoni Group.

19c (21a). Uph unmarked, cilia, dull ochreous brown, broadly chequered at ends veins.

19 (20). F cell spot double. Unf apex and costa vivid rufous. Unh olive rufous with a series of more or less obscure black discal spots.

lucasi, Mab. (35). Lucas' Ace. Mupin, E. Thibet.

20 (19). F. cell spots small separate, all spots small. Unh bright ferruginous shining, base and margin darker, a discal row of small diffused black spots 2–7. Unf apex rather narrowly ferruginous.

evershedi, Evans. (36–37). The Palni Ace. Palnis and Travancore. VR.

21a (19c). Uph a discal yellow patch divided by dark veins.

21 (22a). Uph cilia dull ochreous broadly chequered at ends veins. ♂ unh dull chrome yellow, small black discal spots in 1–7; unf submarginal yellow spots at apex. ♀ unh ferruginous, spots obscure; unf apex ferruginous. Upf lower cell spot absent in ♀ and in ♂ continued towards the base. ♂ with brand.

* *decorata*, M. (30–36). The Ceylon Ace. Ceylon R.

22a (21). Uph cilia yellow, unchequered. Unh yellow with small black discal spots 1–7. ♂ no brand.

22 (23). Uph yellow area broad, diffused. ♂ upf no spot in 1 or very obscure. Unh spots may be absent.

honorei, DeN. (30–36). The Madras Ace. S. India to N. Kanara. R.

23 (22). Uph yellow area narrow and sharply defined. ♂♀ upf a double spot in 1.

* *masoni*, M. (28–34). Mason's Ace. Chin Hills to S. Burma. Tonkin. ? Philippines (1 ♂ B.M.). R.

24a (19b). Uph cilia white. Unf submarginal pale spots at apex.

Insignis Group.

24 (25). Unh dark brown, sparsely overlaid whitish scales leaving dark veins and obscure dark discal spots. Upf spots small, spots in 2 and 3 not overlapping. Uph cilia pure white throughout. Wings produced.

insignis, Dist. (30–34). The White-fringed Ace. S. Mergui, Malay Peninsular, Sumatra, Borneo. VR.

25 (24). Unh densely overlaid pale ochreous scales, leaving a series of large dark discal spots and also a submarginal conjoined series. Upf spots large, spots in 2 and 3 overlap. Uph cilia grey white. Wings rounded.

burmana, Swin. (29–33). Swinhoe's Ace. N. Shan States to Ataran Valley. R.

26 (6b. 19a). Unh a broad continuous white band from mid 1 to apex, spots in 6 and 7 forming part of the band may be small; a spot in cell and near base 7, which may be absent; usually some small discal spots in 5 and 3 just beyond the band; variable number of small submarginal spots in 1–3.

I. 99. Halpe.—(*contd.*)

Unf prominent whitish submarginal spots from 2 to costa. Uph cilia grey white, faintly chequered.

Moorei Group.

moorei, Watson. (30–34). Moore's Ace. S. India, Mussoorie to Burma, Andamans. N.R. Hong Kong, Annam, Siam, Sumatra, Borneo, Bazilan, Jola Is. Celebes. (= *teliga*, Swin, *beturina*, *bazilana and joloana*, Fruh. The Celebes form passes under the name *beturia* Hew and the type in the B. M. = *moorei*, but Hewitson's description applies to the insect Elwes redescribed as *majuscula*, No. 39).

27a (1a). F either a single upper spot in cell or none.

27b (31a). Antennæ above white banded below club.

Zema Group.

27 (28a). Unh prominent continuous white discal band from mid 1 to apex, no submarginal or other markings. Cilia above whitish at tornus F and H, turning brown towards apex.

α. Large. Upf spots large, those in 2 and 3 overlap. Unf with submarginal apical spots. Unh clothed brown ochreous scales; discal band very wide, 2½ mm. Upf 3 apical spots.

* *zema zema*, Hew. (32–37). The Banded Ace. Sikkim to S. Burma, Malay Peninsular. NR.

β. Smaller and darker. Upf spots smaller, those in 2 and 3 separate. Unh discal band narrow, 1 to 1½ mm. Unf submarginal apical spots obscure. Upf 2 apical spots.

zema ormenes, Plotz. Described from Nias. Flies in S. Mergui as a race or variety of typical *zema*, which seems to occur with it (possible races are *vilasina*, Fruh., Sumatra; *vistara*, Fruh., Java; *mahapara*, Fruh., Philippines).

28a (27). Unh no white band.

28a (30). H termen rounded at tornus.

28 (29). F spots prominent, yellow, those in 2 and 3 overlap. Cilia pale to dark ochreous. Below apex F and all H overlaid ochreous brown; unh unmarked or with very obscure postdiscal yellow spots, that in 1 being largest.

kumara, DeN. (32–36). The Plain Ace. Sikkim to Naga Hills. R. (=? *perfossa*, South, S.E. Thibet).

29 (28). F spots small, white, those in 2 and 3 separate. Cilia white on H and brown on F. Below apex F and all H rather dark brown, with more or less prominent post discal small white spots.

fasciata, Elwes. (35). The Bornean Ace. Borneo. VR.

30 (28a). H termen excavated before tornus, wings produced. Upf spots white, those in 2 and 3 overlap. Unh and apex unf olive brown. Unf traces of a pale fascia; unh obscure row of black postdiscal spots. Cilia brownish white on H, brown on F.

knyvetti, Elwes. (32–30). Knyvett's Ace. N. Kanara, VR. Sikkim to S. Burma, NR. Sumatra.

31a (27b). Antennæ above not white banded below club.

Egena Group.

31b (33a). Unh no pale central band. Cilia whitish H, darker on F, unchequered.

31 (32). Upf with spots. Unh with discal black spots which may be outwardly bordered by obscure pale spots, Tegumen hooks pointed and simple, not forked or truncate.

α. Upf often with a cell spot; spots in 2 and 3 overlap, 2 or 3 apical spots. Unh ochreous brown, variable. Unf obscure pale submarginal fascia. Tegumen hooks short.

sikkima, *sikkima*, M. (30–36). The Sikkim Ace. Sikkim to Dawnas. NR. Malay Peninsular, Sumatra, Borneo. (? = *selangora*, Swin, Selangor).

β. Upf cell spot absent; spots in 2 and 3 small, only one apical spot. Rather pale brown above as *hieron*. Tegumen hooks long, longer than tegumen.

sikkima palawea, Stg. Palawan. (*sikkima* probably occurs elsewhere, but is difficult to recognize).

I. 99. Halpe.—(*contd.*)

32 (31). Upf spotless or only a very faint discal spot in 2. ♂ no brand. Very pale brown above. Unf discal and 1 apical spot show. Unh and apex unf olive brown, traces of a pale submarginal fascia. Tegumen horns truncate.

hieron, DeN. (34). The Pallid Ace. Sumatra.

33a (31b). Unh in well marked specimens a white or yellowish central band, divided by dark veins, from mid 1 to apex ; spot in 4–5 large ; submarginal row of pale spots unf and unh ; very variable and there may appear to be two pale areas separated by a continuous row of dark discal spots. Tegumen hooks always truncate, forked or with a side projection (in *sulphurifera*).

33b (37a). Unf submarginal row of spots do not extend into 1, nor is there any pale patch in 1 beyond the band.

33c (36). Tegumen hooks truncate at ends.

33d (35). Genitalia clasp double toothed.

33 (34). H cilia whitish, prominently chequered on F.

α. Small. Unh central band whitish, prominent, continuous.

* *homolea ceylonica*, M. (30–34). The Indian Ace. Ceylon, India. NR.

β. Large. Unh central band very variable, never continuous and often absent.

* *homolea homolea*. Hew. (31–32). Sikkim to Karens. Singapore (= ? *veluvana*, Fruh. W. Java. *homolea* was described from Singapore and until its genitalia are examined its identity will remain in doubt).

34 (33). Above cilia F and H greyish brown, unchequered.

α. Below vinous brown, band and spots obscure. Upf dark, spots small, no cell spot, one apical spot, spot in 2 crescentic.

egena egena, Fd. (30–35). The Dubious Ace. Ceylon VR. (= *brunnea*, M).

β. Smaller. Unh very variable, resembling *homolea*.

egena aucma, Swin. Assam to Tavoy. C. (= *perara*, *marta* and *wantona*, Swin ; ? *kusala*, Fruh, S. Annam).

35 (33d). Genitalia clasp plain.

α. Identical with *aucma*, only to be distinguished by the clasp.

auriferus pelethronix, Fruh. (30–34). The Similar Ace. Tavoy to S. Burma. NR. Java. R.

β. Cilia more ochreous. Spots F small, none in cell, only one apical spot. Unh central band prominent, markings bright ochreous yellow.

auriferus auriferus, El. Nias. R. (= *hazis*, DeN-).

30 (33c). Tegumen forked and tips pointed ; clasp as *homolea*. Cilia as *aucma*. Unh ochreous yellow markings.

flava, **nov.** (30–34). The Tavoy Sulphur Ace. Tavoy to S. Burma. NR.

37a (33b). Unf with a pale marking in 1.

37 (38a). Unf pale marking in 1 discal, a spot across 1 just beyond the brand. Uph clothed long grey hairs. Upf cell spot obscure, 2 apical spots. Unh band pale yellow, prominent.

sulphurifera, HS. (34–38). The Sulphur Ace. Philippines and Sulu Islands. R. (= *luteisquama*, Mab.).

38a (37). Unf pale markings in 1 marginal, an extension of the marginal fascia.

38 (39). Unh markings yellow, prominent. Upf spots complete.

nephele, Leech. (40). The Chinese Sulphur Ace. W. China. R.

39 (38). Unh markings much paler and diffused. Upf no cell spots and only 2 apical spots.

beturia, Hew. (36–38). The Celebes Sulphur Ace. Celebes. (=*majuscula* Elwes).

I. 100. Onryza. The Brush Ace. (Plate 32).

Above brown, dorsum and base F and most of H clothed yellow hairs ; cilia pale ochreous H, brown F. Upf with yellow hyaline spots, double in cell lower part produced towards base, spot in 1 against v1, spot mid 2, in 3 and apical in 6 and 7. Unh and apex costa and cell unf more or less overlaid ochreous scales, tending on F to form a narrow yellow submarginal band and on H leaving a chequered pattern, which is obscure in pale specimens.

* *meiktila*, DeN. (30–34). Meiktila to Dawnas. R. (*siamica*, Riley and Godfrey, N. Siam, is a brighter race).

I. 101. Sebastonyma. The Tufted Ace. (Plate 32.)

Above dark brown with pale yellow hyaline spots on F, figure of 8 spot in cell, spots in 2, 3 and apical 6–8. Uph a pale brown area mid disc. Below dark brown ; unf mid dorsum whitish and a narrow pale yellow submarginal band. Unh broad yellow transverse band from near base at v1 to apex, a streak under v8 from origin to middle and an irregular submarginal line.

* *dolopia*, Hew. (30–34). Sikkim to Karens. NR.

I. 102. Actinor. The Veined Dart. (Plate 32.)

Above brown clothed ochreous hairs on dorsum F and all H, cilia grey ; semi-hyaline pale yellow spots F and H and the veins beyond the spots pale yellow. Upf double cell spot, continuous row 1–5 (double in 1) and conjoined apical spots in 6–8. Uph large spot across cell and postdiscal row 1–5. Below paler and all veins pale yellow ; Unh spots dark edged and more extensive, a spot base 7, central row 1–7 across cell and postdiscal row from 1–6.

* *radians*, M. (34–42). Chitral to Kumaon at 4,000 feet. R.

I. 103. Cupitha. The Wax Dart. (Plate 32.)

Above dark brown with yellow markings. Upf basal half, costa yellow ; a discal band 1–7, the part in 1 continued along v1 towards the base ; lower spot in cell over origin v3, conjoined to the band ; upper end of band incurved in 7. Uph costa yellowish white, yellow transverse broad discal band from 1–4. Cilia pale yellow H, chequered on F. Below entirely yellow except for a broad dark brown central band from base to middle on F and brown tornus F and H.

* *purreea*, M. (28–33). S. India, Sikkim to Burma, Andamans, NR. Malay Peninsular and Islands, Philippines, Celebes. (= *tympanifera*, M.; *verruca* and *lycorias*, Mab.; *alara*, Fruh.)

I. 104. Nicevillea. The Dartlets. (Plate 32.)

Above dark brown with tawny markings. Upf lower part of tawny discal band central not distal as in *Padraona*, etc., i.e. spot in 1 is in the middle of 1, spot in 2 under the origin of v3 and spot in 3 reaches base 3 ; base and costa always dark ; spot in 4 to base 4, may be a discal spot in 5 uniting the discal and apical spots in 6–8 ; spot near end cell against lower edge, conjoined to the spot in 2, but separated by a short black bar from the spot in 3, may be an upper cell spot above it. Uph tawny discal band, but no spot in cell or in 7.

1 (2a). Uph discal band narrow composed of small conjoined spots 1–5. Above very dark with dark orange markings. Upf spot in cell small, no upper spot or spot in 5. Below costa and apex F and all H overlaid dark ochreous green scales, discal band prominent on F but obscure on H.

concinna, El. (30). The Tamil Dartlet. Palnis to Nilgiris. R.

2a (1). Uph discal band broad, continuous, markings bright orange.

2 (3). Below costa and apex F and all H yellow to orange, discal band on H and upper part of F only defined by black spotting.

* *gola*, M. (26–28). The Common Dartlet. Ceylon, S. India, Sikkim to Burma, Andamans. NR. S. China, Malay Peninsular and Islands, Philippines and Celebes. (= *goloides* and *naranata*, M.; *locus*, *fabriolata* and *alfurus*, Plotz.; *taxilus*, *pseudolus*, *akar* and *grandis*, Mab.; *rajagriha*, *trishna* and *nipata*, Fruh.).

3 (2). Below dark brown, sparse ochreous scales on costa and apex F and on H, discal band F and H yellow, sharply defined and not edged black spots.

paragola, DeN. (26–28). The Malay Dartlet. Dawnas to Mergui, Sumatra, Malay Peninsular. Borneo. NR

(The following belong to this genus—*augustula*, HS = *melanion* and *fitjiensis*, Mab. Oceania, Fiji and N. Australia—*wamba*, Plotz, = ? *tabla* Swin and *rudha*, Fruh. New Guinea, Aru and Key Is—*fulvomargo*, Joicey and Talbot, Dutch New Guinea).

I. 105. Taractrocera. The Grassdarts. (Plate 32.)

Above dark brown with pale discal spots in 1–8, those in 4 and 5 shifted out ; an upper cell spot beyond mid cell and a lower conjoined spot towards base. Uph spot mid cell and a discal series 1–7, upper two often absent.

1a (4a). Above markings white to pale yellow, narrow, separated by dark veins, spots in 4 and 5 upf remote from spot in 3 and 6.

1b (3). Unh a pale streak in mid 1 from base to termen, H spots in 1–4 in a straight line. Below spots white. Cilia whitish.

I. 105. Taractrocera.—(*contd.*)

1 (2). Unh no spot mid 7 or base 7 ; spot in 6 large, nearly to base ; spot in cell against upper edge ; no spot in 1 but the white streak is very broad and prominent. Unh closely overlaid greenish scales, veins concolourous.

**danna*, M. (25–30). The Himalayan Grassdart. Kashmir to Bhutan, NR.

2 (1). Unh spot mid 7 and obscure spot base 7 ; spot in 6 small ; cell spot across cell ; a spot in 1 and the white streak is narrow.

α. Unh closely overlaid dark ochreous scales, veins concolorous.

maevius maevius, F. (20–28). The Common Grassdart. Ceylon. C.

β. Unh overlaid dark ochreous to whitish scales, veins prominently pale.

maevius flaccus, F. India, Burma. C. (=*sagara*, M.; *silhetica*, Plotz and *lineata*, Druce, Siam).

3 (1b). Unh no pale streak mid 1 ; spots pale yellow, discal row more curved, a spot mid 7, none base 7.

ardonia, Hew. (22–28). The Malayan Grassdart. Malay Peninsular, Sumatra, Borneo, Celebes. (=*sumatrensis* and *sangira*, Plotz).

4a (1a). Above markings tawny to orange.

4b (7a). Uph or unh a yellow spot mid 7.

4 (5a). Unf yellow cell spot not nearly as far back as the origin of v2.

α. Above spots small and separate. Upf usually no spot in 1, spots in 4 and 5 remote from those in 3 and 6, cell spot small and against upper edge. Uph spots in 4 and 5 remote from those in 2 and 3, spot in 6 often absent, no spot in 7. Unh more or less overlaid dark ochreous scales.

ceramas ceramas, Hew. (22–27). The Tamil Grassdart. Travancore to N. Kanara. NR, on plateaux.

β. Above all markings much broader. Upf spots in 4 and 5 touching spot in 6, remote from spot in 3 ; always a spot in 1. Uph complete conjoined series 1 or 2–7, spot in cell prominent. Unh overlaid ochreous scales leaving blackish edges to the spots.

**ceramas nicèvillei*, Wat. N. Kanara to Bombay. NR. (=*coras*, Auct nec Cramer).

γ. Above markings still more extensive ; upf spots in 4 and 5 touch spots in 3 and 6. Unh completely overlaid ochreous scales, cell spot and elongate spot in 4–5 only visible by translucence.

ceramas oberthuri, El. Anaimalai Hills, S. India. VR.

δ. Above as *ceramas*, but uph spots in 2 and 3 touching spots in 4 and 5. Unh margin only yellow giving a prominent black spotted effect round the yellow spots.

ceramas atropunctata., Wat. Chindwin, N. Burma, Hong Kong, R.

5a (4). Unf yellow cell spot at least as far back as the origin of v2 ; upf always a spot in 1.

5 (6). Unh a yellow spot base 7. Above markings very broad and rather pale yellow ; spots in 4 and 5 joined to spots in 2 and 3, cell and costa yellow. Uph discal series complete and conjoined, cell spot large. Unh overlaid ochreous scales, leaving prominent small black spots. Apex F more produced than usual.

flavoides, Leech. (26). The Chinese Grassdart. W. China. R.

6 (5). Unh no spot base 7. But for the antennæ exactly like *Padraona mæsoides*. Unh yellow spots more or less separated by black veins.

α. Above markings narrow and all divided by black veins. Upf spots in 4 and 5 remote from spots in 3 and 6, cell spot only reaching to origin v2. Uph small cell spot, discal row 1–5. Below apex F narrowly and all unh overlaid sparse ochreous scales : unh spot mid 7 and small spot base 6.

ziclea samadha, Fruh. (22–28). The Veined Grassdart. Thayetmyo to S. Burma, Peninsular Siam. VR.

β. Above darker ochreous and markings broader ; upf spots in 4 and 5 join spot in 3 but not spot in 6. Uph spot in cell obscure. Unh darker due to less ochreous scaling, veins towards termen distinctly darkened.

**ziclea tissara*, Fruh. Sumatra, Borneo, Java. (Fruh, separates the form from Java as *ikramana*. The Philippine race is *ziclea*, Plotz.=*luzonensis*, Mab., *sudodana*, Frub. is the race described from Sumba).

7a (4b). Uph or unh no spot mid 7. Upf markings broad, spots in 4 and 5 almost completely overlapping the spot in 3 ; cell yellow. Uph spots coalesced.

7 (8). Upf spots in 4 and 5 just touching the spot in 6 ; the yellow cell area

I. 105. Taractrocera.—(*contd.*)

may be conjoined to the discal yellow band through the spot in 2. Uph usually a spot in 6 ; cell spot prominent or absent.

* *archias quinta*, Swin. (22–28). The Yellow Grassdart. N. to S. Burma, VR. Siam, Annam, Malay Peninsular, Borneo. (The following races have been described—*nigrolimbata*, Snell = *turica*, Plotz, Java=*godhania*, Fruh, Sumba=*kisaga*, Fruh, Lombok=*bavius*, Mab., Timor=*antalcidas*, Fd, Celebes=*archias*, Fd. Amboina=*udraka* Fruh, Dutch New Guinea).

8 (7). Upf spots in 4 and 5 overlapped by spot in 6, forming a compact band from dorsum to apex : the yellow area in the cell may or may not be joined to the discal yellow area in 2. Uph usually no spot in 6 ; cell spot present or not. Smaller than *archias*.

aliena, Plotz. (20–25). The Alien Grassdart. · Java. (=*myconius* and *dischaka*, Plotz. and *dhshalia*, Mab. Probably *talantus*, Plotz from Celebes is an *aliena* race).

(The Australian group have a brand on upf and appear to comprise 3 species—*dolon*, Plotz., N. Queensland, for which the older name may be *rectivitta*, Mab.—*anisomorpha*, Lower, N. Queensland—*papyria*, Bdv., Australia=*agraulia*, Hew., *fumosa*, Guest., *celaeno*, Cox, *alix*, Plotz and *minimus*, Miskin).

I. 106. Padraona. The Darts. (Plate 32.)

Above marked much the same as in the last two genera. Upf the discal band with the lower part distal, spot in 1 beyond the middle of 1 and spot in 2 beyond the origin of vein 3 never joining spot end cell.

1a (3a). Upf no spots in 4 or 5.

Fettingi Group.

1 (2). Above dark brown with a purple sheen. No ♂ brand. Markings very narrow, dull yellow and separated by veins. Upf double elongate spot end cell, discal spots 1–3, apical 6–7. Uph discal spots 1–4, no cell or costal spot. Below as above, unf purple brown, apex and all unh overlaid dark ochreous scales ; discal spots unh purplish. Tegumen simple, tapering to a blunt point ; clasp simple, rounded.

purpura, **nov.** (32). E. Java, 5,000 feet. The Purple Dart.

2 (1). Above no purple sheen. All markings narrow, orange, separated by veins. Uph discal band 1–5, no spot in cell or in 7.

α. Above generally paler and markings broader, cell spot obsolete upf. ♂ upf a continuous dark shining silky brand (disappears with petrol) mid 1 to base 3, behind the yellow discal band. Uph spot in 4–5 small and against outer edge of the spot in 3. Unf apex and all unh ferruginous ; unf discal band and cell spot yellow ; unh a spot in 6. Tegumen broadly bident ; clasp with dense fine hairs at tip.

fettingi fettingi, Mosch. (33). Sumatra. (= *euria*, Plotz and *pavor*, DeN.)

β. Above darker and markings broader ; cell spot prominent and prolonged towards base along mv. Uph discal spots in 2, 3 and 4–5 equal. ♂ brand black, hard to see (not disappearing with petrol), irregular, disconnected. Below much darker ferruginous, veins on H black, no spot in 6, traces of cell spot, sometimes basal and central spot in 7. Unf cell spot, discal band and apical spots yellow ; unh spots very dark orange, but a yellow detached spot in 1.

fettingi orfitus, Mab. W. Java.

3a (1a). Upf always a spot in 4 and in 5.

3 (4a). ♂Upf with a black brand behind the yellow discal band, continuous and narrow. Uph no costal spot in 7. Upf in ♂ the discal yellow band from 1–5 very straight and even width throughout, joining the outer edge of the spots in 6–8 ; in ♀ the lower part 1–3 is wider as usual ; cell and costa all yellow to central black Y band in ♂, basal half dark in ♀ ; a dorsal streak from discal band to base in ♂ and a streak above it in 1 from inner edge of brand to base. Uph continuous broad discal band from 1–5, continued into 6 by a small inner spot ; cell spot present. Below costa and apex F and all H rather pale yellow, discal band H defined by irregular narrow black edging. Tegumen simple, tapering to a blunt point, clasp simple rounded.

I. 106. Padraona.—(*contd.*)

Kobros Group.

kobros rectifasciata, El. (29–32). The Branded Dart. Karens to S. Burma, NR. (*cakka*, Fruh. is the darker race from Java; *sravasta*, Fruh. from Nias and probably occurs on Sumatra; *kobros*, Plotz.=*procles*, DeN., occurs on Aru, Key, Mysol and Gilolo; the following are probably referable to *kobros*—*tranquilla*, Swin., Milne Bay. N. G.—*terranea* and *paceka*, Fruh., Dutch New Guinea—*dhamika* and *dipavansa*, Fruh., Waigou. The following species belong to this group with a brand upf from 1–4—*walkeri*, Heron, N. Australia—*heterobathra*, Lower, N. Australia and Key Is.).

4a (3) ♂ upf no brand from v1–4. Uph usually a costal spot mid 7 and a cell spot; unh also a spot base 7.

Dara Group.

(The examination of the genitalia has proved that the *dara* group contains a number of almost exactly similar species; numerous names have been published usually with inadequate descriptions; I have assigned these names as best I can so as to avoid the creation of more names; only a genitalia examination of the types will settle the matter of names finally.)

4 (5a). Upf no brand at all; cell and costa yellow to the dark Y band, may be a dark narrow basal streak in the cell; discal band confluent and touching the outer edge of the apical spots, spot in 5 overlaps the spot in 4. Uph discal band confluent, spots in 4 and 5 not advanced; spot in cell and mid 7. Tegumen broadly tapering and minutely bifid.

α. uph discal band usually continued into 6 by a short bar on inner edge towards spot in 7. Unf apex and all unh yellow, discal band defined by prominent small black spots; base H black dusted. Unf cilia obscurely chequered in ♂, prominently in ♀.

phellus phellus, Mab. (23–27). The Brandless Dart. Sikkim to S. Burma. NR.

β. Upf a narrow yellow discal streak over v1 from discal band to base. Uph no spot in 6. Below yellow scaling sparser, effacing the black spotting; unh no spot in 6.

phellus tanya, Fruh. (24–28). Java. NR.

5a (4). Upf ♂ with a short obscure brand over middle of v1, behind the discal band or just entering the yellow discal area, easily seen with petrol.

5b (8a). Upf and uph discal band divided by dark veins. Upf spot in 4 does not overlap spot in 3 and spot in 5 does not touch spot in 6 as a rule.

5c (7). Unh no discal spot in 6 linking the discal band to the spot in 7.

5 (6). Large. Tegumen broadly, bident tip clasp fringed.

α. Upf markings narrow, costa and base dark. Unh very dark ferruginous ochreous. Uph discal band not entering 6.

hetaerus zatilla, Plotz (31–35). The Large Dart. Bassein to S. Burma. VR. (2 specimens examined).

β. Above markings broader; upf spot in 5 just touches spot in 6 and spot in 4 just overlaps spot in 3; uph discal band just enters 6 centrally as in *augias*.

hetaerus chariyawa, Fruh. Java. (1 specimen examined).

γ. uph discal band very irregular, spots in 4 and 5 shifted out and the discal band just entering 6 by a spot on the inner edge of 5. Markings broad.

hetærus hetærus, Mab. Philippines. (1 examined).

6 (5). Small. Tegumen slenderly and gradually pointed, tip of clasp pointed and not conspicuously fringed. Upf markings narrow; costa and base cell ochreous with a black streak in the cell or may be all darkened at base. Uph spots in 4 and 5 overlap to the middle of 3, no extension into 6. Unh dark ochreous with discal band showing prominently, no black spotting.

α. Above markings very narrow and unh very dark.

mæsoides ottala, Swin. (24–28). The Lesser Dart. Karens. R.

β. Above markings wider and unh not so dark.

* *mæsoides mæsoides*, But. Dawnas to S. Burma, Malay Peninsular, Banka. C. Probably throughout Macro-Malayana. (?=*flavoguttata*, Plotz, Philippines).

γ. Larger. Upf markings narrow. Uph discal band more confluent and spots in 4 and 5 shifted out.

mæsoides ottalina, **nov.** (29). Andamans, VR,

I. 106. Padraona.—(*contd.*)

7 (5c). Unh a spot in 6 connecting the discal band in 5 to the spot in 7. Tegumen undivided.

α. Above markings very narrow and pale yellow; cilia grey throughout. Uph a spot in 6 against the inner edge of the spot in 5 and a spot in 7, which may be obscure or absent. Unh pale yellow, black dusted, discal band outlined black spots. Tegumen blunt, slightly expanding.

dara dara, Koll. (27–29). The Common Dart. Chitral to Kumaon from 4 to 10,000 feet. NR. (=*maesa*, M.; *nala*, Plotz. *zebra*, Mab).

β. WSF above and below darker, markings darker and broader. Uph usually no spot in 6 or 7; tegumen blunt not expanding. DSF much paler below and above; wings rounded as in ♀♀; tegumen bluntly triangular.

dara pseudomæsa, M. (27–30). Ceylon. S to Central India. C.

γ. Larger and more brightly coloured. Same seasonal differences in appearance and genitalia. Unh in WSF is bright orange, prominently black spotted. Uph often a spot in 6 and usually one in 7. Very variable.

* *dara confucius*, Fd. (29–36). Mussoorie to Shan States, NR. China (allied race *angustata*, Matsum = *pava*, Fruh, Formosa).

δ. Comparatively small. Uph usually no spot in 6. Unh duller, black spotting not so much in evidence.

dara serina, Plotz. (28–33). S. Burma, Malay Peninsular, NR. Sumatra, Java, Lombok, Sumba, Sumbawa, Nias. (=*yojana*, *ganda*, *sapitana*, Fruh).

γ. Very dark with narrow pale yellow markings. Unh pale yellow. Tegumen as in DSF form of *pseudomæsa*.

dara dilutior, Elwes. (28–33). Borneo, Pulo Laut. (=*ahastina*, Fruh).

8a (5b). Upf and uph discal band confluent; upf spot in 5 usually touching and may be conjoined to the spot in 6 and the spot in 4 overlaps the spot in 3.

8b (10). Unh a spot in 6 connecting the discal band to the spot in 7; uph spot in 6 may be present and always a spot in 7.

8 (9). Tegumen variable, but never ending in 2 long points as in *nitida*, always broadly bident.

α. Small. Upf discal band completely confluent from 1 to apex.

sunias satra, Fruh. (22–25). Ceylon and Andamans, C. The Tropic Dart.

β. Larger. Upf apical spots in 4 and 5 not completely conjoined to the discal and apical spots. Very variable.

sunias tropica, Plotz. (25–34). S. India, Sikkim to Burma, Malay Peninsular and Islands to Celebes. C. (=*palnia*, Evans; *dushta* and *nikaja*, Fruh.; *philænus*, Mab. incorrectly assigned a brand from 1–4 by Elwes. *flava*, Murray = *japonica*, Mab is the race from Japan and China). The specimens I have examined show the following variation:—

Var. 1. Unh bright ochreous, black spotting prominent. Markings broad. (25–29 mm.) from S. India, N. Shan States to Tavoy, Sumatra, Java, Batoe Is. and Celebes—23 examined.

Var. 2. Unh pale yellow, band and black spotting obscure. (26–29). From Assam to Karens—4 examined.

Var. 3. Unh darker, black suffused presenting a greenish appearance. (27-33). from S. India, Sikkim to Dawnas, Sumatra—14 examined. This is what I described as *palnia*.

Var. 4. Darker above with very narrow markings. (25–29), from Rangoon to S. Mergui—4 examined.

Var. 5. Dark with broad markings. Unh dark greenish. (30–34), from Karens—2 examined; may be a var. of *hetaerus*.

γ. Above markings darker and tend to be separated by veins. Unh dark orange band rather obscurely black edged.

sunias sunias, Fd. (25–27). Moluccas. (=*ahrendti*, Plotz.).

9 (8). Tegumen deeply bident. Superficially inseparable from some forms of *sunias*. Unh ochreous, black spotting prominent. Upf ♂ brand longer than usual, covering centre third of v1; dorsal yellow streak restricted, not reaching to outer edge of the discal band.

nitida, Mab. (26–28). The Narrow Bident Dart. Ataran and Tavoy, NR. (8♂ and 3♀). Philippines (1♂).

10 (8b). Unh no spot in 6; black dusted and discal band prominent. Above much darker than usual, markings very dark orange. Very like *mæsoides*. Tegumen broadly bident.

I. 106. Padraona.—(*contd.*)

trachala, Mab. (24–26). The Broad Bident Dart. Assam to Burma, C. Malay Peninsula, Sumatra, Java and Borneo.

I. 108. Telicota. The Palmdarts. (Plate 32.)

Above dark brown with yellow to orange band of decreasing conjoined spots 1–5, to outer edge of apical spots in 6–8 ; costa to apical spots and all end cell may be yellow leaving only a dark central band from mid 1 to v5 or, usually ♀♀, cell and costa may be dark leaving only a yellow spot end cell ; basal $\frac{1}{2}$ of 1 usually dark with a tawny streak along v1 ; dorsal streak from base to discal band. Uph normally cell spot joined to base by a yellow streak and a broad discal band of conjoined spots 1–4 or 5, but uph may be plain tawny. Unf dark brown ; apex and costa F and all H overlaid from pale ochreous to dark ferruginous scales ; markings at apex F and on H may be edged black spots. All species are very variable.

1a (4). ♂ with an alar sex mark.

1b (3). ♂ with a prominent brand upf mid 1–base 4, no tuft. ♂ with a straight grey brand in the middle of the black central band ; F v3 from mid 2 and 4. ♂ upf cell yellow and costa yellow to the apical spots ; basal half of 1 yellow, black dusted. ♀ base dark leaving yellow spot end cell. Uph cell spot and discal band well marked. Unh very variable, discal band usually outlined black dots. Tegumen deeply divided.

Augias Group.

1 (2). Upf outer edges of discal spots deeply excavated and continued along veins to termen in ♂, a similar tendency uph.

augias augias, L. (30–35). The pale Palmdart. Ceylon, S. India to Sikkim to Burma, Andamans, NR. China, Malay Peninsular and Islands to Australia. (= *colon*, F. The Australian race is *krefftii*, McLeay = *olivescens*, HS. *argeus*, Plotz, *ancilla*, HS. and ? *anisodesma*, Lower).

2 (1). Upf outer edge of discal spots hardly excavated ; veins at termen not yellow. Tegumen stouter and clasp more compact.

α. Rather paler.

* *pythias bambusæ*, M. (30–35). The Dark Palmdart. Ceylon, India, Burma, Andamans. China, Hainan, Siam, Annam and Tonkin. C. (Fruhstorfer separates the Formosan form as *formosana*).

β. Rather darker.

pythias pythias, Mab. Malay Peninsular and Islands. (The named races are—*upadhana*, Fruh., Lombok—*rasana*, Fruh., Phillippines—*rahula*, Fruh., Celebes. Some 14 names have been assigned to *pythias* like forms found in the Moluccas, New Guinea and Australia ; there are certainly 2 or perhaps 3 species in the area. In New Guinea, Aru and N. Australia there flies an allied species with an irregular brand, for which the oldest name is probably *macleayi*, Pl. Australia = *autoleon*, Misk with races *aruana*, Pl. Aru and *silativa*, Swin., New Guinea).

3 (1b). ♂ uph with a tuft of hairs from base 6. Bases dark : H no cell spot. Unh discal band not traceable ; uph with a discal band (absent in some races).

Prusias Group.

prusias insularis, El. (34–40). The Tufted Palmdart. Borneo, Pulo Laut. (= *kreon*, Fruh. The Philippine race is *prusias*, Fd. = *matinus*, *sariputra* and *padhana*, Fruh. Moluccan race *batchiana*, Swin. Celebes *hercules*, Mab. = *androsthenes*, Fruh. and New Guinea *tenebricosa*, Mab.).

4 (1a). ♂ no alar sex mark. ♂ upf dark central band constricted in the middle opposite v2 ; spots in 4 and 5 present and touch the spots in 6–8 ; markings very broad, all cell and costa yellower markings narrow and base darkened. ♀ yellow spot at end cell. Below yellow brown to ferruginous, lilacine glaze in ♀. End of tegumen trident.

Augiades Group.

* *palmarum*, M. (35–45). The Plain Palmdart. Calcutta to Assam to Burma, Siam, Malay Peninsular and Islands. NR. (= *raktaja*, Fruh. ; *kayapu*, Doh ; *baweana*, Fruh. ; the Philippine race is *chrysozona*, Plotz. = *negrosiana*, Fruh. From the Celebes to Australia numerous names have been assigned to what probably represent 3 or 4 species belonging to the brandless group of Telicota. A great deal of research work is still required to clear up the identity of the species belonging to this and allied genera in the Papuan region).

I. 109. Augiades. The Darters. (Plate 32.)

Above tawny with dark borders or dark brown with yellow spots F and H. Upf always spots in 1–3 and 6–8.

1a (6a). Unh without spots or with a continuous discal row of ochreous spots 2–6 or 1–7 and a more or less prominent spot end cell. Upf spots non-hyaline (except *subhyalina*) and spaces 4, 5 near termen with spots or ochreous.

1b (3a). Unf dorsal area below v3 entirely pale, except below v1 and basal half of space 1, which is black, and a more or less apparent dark terminal border.

1 (2). Uph tawny discal area not to v7 and no traces of spots uph or unh. Tawny with black veins.

ochracea, Brem. (28–32). The Amur Darter. Amur, Corea. (= *rikuchina*, But, Japan, a larger race).

2 (1). Uph tawny area to v7 ; always at least traces of pale yellow spots upf and uph.

α. Upf tawny with broad dusky border and patch end cell. Unh greenish with the spots pale yellow.

sylvanus sylvanus, (28–36). The Palæarctic Darter. Europe to N. Asia. C. (There are a number of named European forms ; nearly allied races are *anatolica*, Pl. Asia Minor and *hyrcana* Christoph, Persia).

β. Larger. ♂ paler, dusky areas faint ; below yellow, markings faint. ♀ rather dark brown with the discal spots pale yellow ; below dusky over the yellow base, spots prominent.

sylvanus venata, Br. and Gr. (37–40). Altai and Turkestan to Amur, N. China and Japan. (= *selas* and *amurensis*,, Mab. *herculea*, But.).

γ. ♂ above borders broad and dark. Above and below veins prominently black.

sylvanus majuscula, El. (43). Shanghai.

3a (1b). Unf dorsum below v3 entirely dark brown, except for the yellow discal spots. Above dark brown with yellow or tawny spots and with ochreous hairs basally : upf double spot end cell and in ♀ a spot in base 2 ; costa and cell more or less tawny.

3b (5). Upf none of the spots hyaline.

3 (4). Wings produced. Cilia fuscous grey. Below much darker than the next and the spots more prominent.

similis, Leech. (38). The Similar Darter. West China.

4 (3). Wings rounded. Cilia pale yellow. Below costa and apex F and all H overlaid greenish ochreous, obscuring the spots, Tegumen with 4 horns as in *sylvanus*.

sylvanoides, Leech. (34). The Chinese Darter. West China.

5 (3b). Upf spots above v2 hyaline. Wings rounded and cilia pale yellow. Below costa and apex (to tornus) and all H overlaid dense ochreous scales. Tegumen with 2 horns.

α. Larger.

subhyalina subhyalina, Br. and Gr. (44–48). The Sub-hyaline Darter. Amur, Corea and Japan.

β. Smaller.

subhyalina thibetana, Ob. (36–40). C. and West China. Thibet, Assam. R.

6a (1a). Unh with 3 sharply defined, dark edged, white (yellow in *cratæis*) discal spots in 2, 3 and 6 ; sometimes traces of a spot end cell. Above dark brown, basally clothed ochreous hairs ; prominent hyaline yellow spots F and H, and sometimes traces of spots uph in 4 and 5 ; upf no spots in 4 and 5 (rarely a dot in 4), spots in 2, 3, end cell and apical 6–8, also non-hyaline spot in 1. Unf dorsal area below v3 dark brown, except for the discal spots. Below cell, costa and apex to tornus F and all H overlaid dark ochreous scales. Cilia yellow grey. Tegumen with 2 front and 2 back horns.

6b (8a). ♂ upf brand uniform black.

6 (7). Wings rounded. Top of clasp convex or flat.

bouddha, Mab. (32–35). The Buddhist Darter. West China and S. E. Thibet. (♀ var *consors*, Leech with white spots upf).

7 (6). Wings produced. Top of clasp concave and produced.

* *siva*, M. (34–40). The Assam Darter. Assam to Karens. NR.

8a (6b). ♂ upf brand with a central whitish line, interrupted at v1.

8 (9). Comparatively small. Unh spots white. Upper apex of clasp produced.

I. 109. Augiades.—(*contd.*)

brahma, M. (31–37). The Himalayan Darter. Mussoorie to Sikkim. Sylhet, Chin Hills. NR.

9 (8). Comparatively large. Unh spots yellow. Upper apex of clasp not produced.

cratæis, Leech. (43–46). The Great Darter. West China.

I. 110. Pamphila. The Chequered Darter. (Plate 32.)

Above tawny with dark borders. Unf paler; apex F and all H overlaid ochreous to green. Unf 3 apical spots in 6–8 and 2 discal in 4 and 5 near margin; unh curved discal row 1–7, spot in cell and on either side of it at bases 1 and 7; spots white. These spots appear above as tawny spots, usually prominent on F and obscure or invisible on H.

α. Above dusky borders broad. Unh greenish to reddish grey.

comma comma, L. (30–35). Europe to Amur. (There are many named European forms).

β. Above border very narrow and sharply defined. Unh greenish, spots white and glossy.

comma mixta, Alph. Tian Shan, Ferghana and Turkestan.

γ. Above border broad dusky, elsewhere dark tawny. Unh dark green, discal spots dark bordered, conjoined or nearly so.

* *comma dimila*, M. Chitral to Kumaon. (*lato*, GG, from the Dschakar Mts., Thibet and ? West China is probably a good race).

δ. Above very dark and dusky border very broad, leaving only spots on H. Unh ochreous, spots obscure, whitish, reduced, usually only spot in cell and discal row 2–6.

comma florinda, But. Japan and Amur (=*repugnans*, Stg. and *micado*, Mab).

I. 111. Thymelicus. The Midgets.

Above red to golden ochreous with dark borders and in some species dark bases, areas end cells and veins. No species has as yet been recorded from Indian limits.

1a (6a). Veins nowhere conspicuously black.

1b (5). ♂ with a brand upf.

1c (3a). ♂ brand continuous from v1 to base 3 and not reaching mv till mid 2 and 3. Above border narrow, well defined.

1 (2). Above more or less overlaid dark ochreous; ♀ with pale yellow spot end cell and a discal row 3–8, which may appear more or less in the ♂. Below golden yellow; dorsum F dark brown. Costa = 1¼ dorsum.

actaeon, Rott. (27). The Dark Midget. Prussia to South Europe, North Africa and Syria. (There are several named forms, that from Syria being *phoenix*, Graves).

2 (1). Above reddish yellow, unmarked. Below apex F and all H except dorsum greenish ochreous, rest reddish yellow.

thaumas, Hufn. (28). The Common Midget. Europe and Asia Minor (several named forms, the Syrian being *syriaca*, Tutt).

3a (1c). ♂ upf brand broken at v2, upper part lying against mv. throughout.

3 (4) ♂ brand long, lower part crosses space 1; upper part to under v3. As *thaumas*, but border above broader and more diffused.

hyrax, Led. (27). The Dusky Midget. Asia Minor to Turkestan.

4 (3). ♂ upf brand thin and short, lower part consists of a spot under v2 and upper not to origin of v3. Above pale golden yellow, border very narrow, and sharply defined.

lineola, Ochs. (27). The Golden Midget. Europe to Turkestan and Algeria. (There are several named European forms).

5 (1b) ♂ no brand. Above border broad, sharply defined, bases dark. Below uniform pale ochreous; unf dorsal dark area to ⅔ along v2.

stigma, Stg. (28). The Turkestan Midget. Turkestan.

6a (1a). Veins conspicuously black. Tawny above and below.

6 (7a). ♂ upf brand as *thaumas*, ♂ above border narrow, ♀ border broad, bases dark and a dark patch at end cell F; unf tornal dark patch not to dorsum.

leonina, But. (30). The Tawny Midget. Japan, Corea, Amur. West

I. 111. Thymelicus.—(*contd.*)

China. (The West China form is smaller and probably deserves a racial name).

7a (6). ♂ no brand.

7 (8). F no black streak in cell and unf dark tornal patch not to dorsum.

α. Above borders broad, basal area H/dark ; dorsum F dark throughout.

nervulata nervulata, Mab. (30). The Veined Midget. West China.

β. Above borders narrow and generally less dark.

nervulata astigmata, Leech. C. China.

8 (7). F a black streak in cell and unf dark tornal area to dorsum. Above borders very broad and bases dark also a dark area at end cell F ; dorsum not continuously dark but divided by a pale area in the middle ; in ♀ cell is dark.

α. Paler.

sylvatica sylvatica, Brem. (30). The Chinese Midget Japan, Amur and Corea.

β. ♂ darker. ♀ nearly black.

sylvatica occidentalis, Leech. West China.

γ. Above with purple reflexions. Below veins broader black.

sylvatica tenebrosa, Leech. C. China.

I. 114. Iton. The Wights. (Plate 32.)

1a (3). Unh cell all white. Above dark brown ; upf with white hyaline discal spots in 2, 3 and 4 (and sometimes 5) and apical 6–8, often nonhyaline spot in 1, which does not show unf. Below dark brown, costa and apex F and dark areas H overlaid ochreous scales ; unf mid termen whitish. Unh dark brown costa above cell and v7, dark brown central area below cell and dark margin, remainder white.

1 (2). Uph broad white tornal area extending to half-way up dorsum and to v4 ; dark marginal area usually tapers to v1 but may end there broadly. Unh central dark area absent or at most small in 2 and 3 ; marginal band in spots separated by white veins. ♂ unf a dense tuft of upturned black hairs from near base dorsum.

**semamora*, M. (42–46). The Common Wight. Sikkim to Burma, Malay Peninsular, Sumatra, Borneo and Philippines. NR. (=*barea*, Hew and *adamsoni*, Swin).

2 (1). Uph tornal white area absent or obscure, more developed in ♀ and divided by black veins. Unh the central dark area large in 1–3 ; marginal band not broken into spots and much broader. ♂ unf no tuft.

watsonii, DeN. (44–48). Watson's Wight. Chin Hills to Dawnas. West Siam. Perak (Adams' coll.). NR.

3 (1a). Unh no white in cell and not overlaid ochreous scales. Upf spots in 2, 3, 6–8. ♂ unf no tuft.

azona, Hew. (56). Celebes.

I. 115. Baoris. The Swifts. (Plate 32.)

Above dark brown, bases may be clothed ochreous hairs ; upf with separate white or pale yellow hyaline spots, to a maximum of 2 in cell, 1 or 2 (nonhyaline) in 1, in 2, 3, 4 and apical 6–8. Uph unmarked or the spots unh may appear. Below dark brown, costa and apex F and all H usually overlaid greenish or ochreous scales ; unf often a pale diffused discal patch in 1. Unh may have up to a maximum of a pale spot in cell against mv and a discal row 1–6.

1a (9a). ♂ with alar sex-marks.

1b (3a). ♂ with no brand upf.

1 (2). ♂ uph a prominent tuft of paintbrush like recumbent hairs, dark brown, springing from below costal vein between origin of vs 7 and 8 and overlying loose grey modified scales occupying the whole cell ; unf a polished dorsal area below v2, containing a yellow brown oval brand on either side of the middle of v1 ; dorsum F bowed. ♂ upf very dark brown, never a spot in 1 ; ♀ usually fully spotted. Uph spotless. Unh may rarely have small spots in 2 and 3 in ♀ ; not overlaid usually.

Oceia Group.

α. Upf no cell spots and usually no apical spot in ♂. ♀ unf single diffused spot in 1.

. **115. Baoris.**—(*contd.*)

oceia penicillata, M. (38–47). The Paintbrush, Swift, Ceylon. NR.

β. Very variable, from fully spotted to spotless (var *unicolor*). ♂ clasp outer angle produced as a spine. Below slatey brown, not overlaid ochreous scales.

* *oceia farri*, M. South India to Sikkim to Burma, Andamans, Siam, Tonkin, Hong Kong, Malay Peninsular, Sumatra, Nias, Java. C. (= *scopulifera* and *unicolor* M. *sikkima*, Swin).

γ. Unh greenish yellow brown.

oceia leechi, Elwes. C. and West China.

δ. Unh purple brown.

oceia simillima, Elwes. Borneo, Pulo Laut.

η. Unh plain brown as in α and β. Clasp outer angle sloped.

oceia oceia, Hew. Philippines. (= *neophytes*, Mab.).

2 (1). ♂ unf a brush of upturned dark brown hairs from along dorsum. F no cell spots; ♀ no spot in 1, in ♀ 1 or 2; unf whitish discal area in 1, obscure in ♂, large in ♀. Unh plain dark brown in ♂; in ♀ more or less overlaid dark ochreous scales and may be spots in 2 and 3; ♀ very like ♀ of *kumara*, but unf spot in 1 not separable into 2.

Plebeia Group.

plebeia, DeN. (36–38). The Tufted Swift. Sikkim to Burma, Java, Borneo, Pulo Laut. (= *mormo*, Mab.). NR.

3a (1b). ♂ upf a whitish centred seam from mid v1 to ⅓ along v2 (under the discal spot in 2).

Mathias Group.

3b (7a). F v2 opposite v11 or just before it. Wings produced. F with 2 cell spots; ♀ 1 or 2 spots in 1 upf.

3c (5a). Uph and unh unmarked. Antennæ long = v12.

3 (4). Above dark brown, bases overlaid dark greenish hairs. Below purple brown, more or less overlaid on H with dark ochreous scales. ♀ very like *cahira* ♀, but v2 F is nearer v11.

brunnea. Snell. (44–47) The Dark Branded Swift. Sikkim to Burma, S. Annam, Java, Bali, Borneo. NR. (= *coere*, DeN. and *sodalis*, Mab.).

4 (3). Above brown overlaid yellow hairs. All spots small and yellow; no spot in 8. Below brown, overlaid ochreous. Tegumen long ending in two divergent points and with two incurved side horns (as *conjuncta*); clasp as *sinensis*. Palpi 3rd joint more prominent than usual. Below body, etc. ochreous.

flava, **nov.** (40). The yellow Branded Swift. Kanbauk, Tavoy, one male April 1924.

5a (3c). Unh and sometimes uph more or less white spotted. Cilia grey. Unh overlaid greenish scales. Tegumen divided. Antennæ short, shorter than v12.

5 (6). Large. Tegumen not tapering. Unh with prominent spots in cell and discal 2–6, some may be absent and some show uph.

α. Tegumen tips parallel or divergent. Unh spots rarely complete and rarely showing uph.

sinensis subochracea, M. (36–39). The Large Branded Swift. Ceylon, S. India to Bengal. R.

β. Tegumen tips connivent. Spots usually complete and usually appearing uph.

* *sinensis sinensis*, Mab. (40–47). Kangra to S. Shan States. W. and C. China. NR. (= *prominens*, M. and *similis*, Leech).

6 (5). Tegumen tapering, tips connivent. Unh spots much smaller, very variable, may be a full series (cell and 1–7) or none; uph usually unmarked, but frequently the spots in 3, 4 and 6 may show.

α. Very pale.

mathias thrax, Hub. The Small Branded Swift. Aden, Syria, Mesopotamia, Lahej.

β. Pale.

mathias midea, Walker. (32–38). Sind, Cutch and S. Punjab. C.

γ. Normal dark brown form. Typically with prominent spots upf; a larger darker form occurs with the spots reduced or absent (*agna*).

mathias mathias, Fab. Ceylon, India, Burma, Andamans. C. Japan,

I. 115. Baoris.—(*contd.*)

Formosa, China to Australia. (= *agna* and *chaya*, M. ; *monilis*, Mab. ; *juliana*, Lat. ; *ella*, *balarama*, *ceramica*, Plötz. ; *niasica*, Fruh ; the Australian race seems larger and might stand as race *lyelli*, Roth, described from Vulcan Is.)

7a (3b). F v2 well before v11. Unh white spots in 2–5, which may show uph. Antennæ short, not as long as v12. Wings broad.

7 (8). Above pale brown, upf 2 cell spots ; brand in ♂ prominent and more oblique than usual. Below overlaid greenish scales.

mencia, M. (42). The Chinese Branded Swift. Shanghai, Nankow, Ningpo, Kiukiang.

8 (7). Above dark brown, single upper cell spot upf ; brand incomplete and obscure, in two parts and lower part may be absent. Below much darker and overlaid ochreous scales.

nascens, Leech. (44). The Semi-branded Swift. W. China.

9a (1a). ♂ no alar sex mark.

9b (22a). Antennæ long, at least as long as v12.

9c (17a). Uph never spotted and unh at most 2 spots (in 2 and 3) in some ♀♀, very rare in ♂. Dark brown.

Philippina Group.

9d (14a). Upf with spots in the cell.

9 (10a). Upf spots in cell conjoined to a figure of 8 ; ♀♀ with a spot in 1. Below dark brown, not overlaid differently coloured scales. Above spots pale yellow. Cilia greyish to pale yellow.

pagana, DeN. (46–50). The figure of 8 Swift. Sikkim to Dawnas, NR.

10a (9). Upf cell spots not conjoined.

10 (11a). Upf spots in cell prominent and sub-equal (in individuals the spots may be somewhat obscure) ; Cilia greyish. Below more or less overlaid dark ochreous scales. Normally with no spot in 1 upf in ♂ ; ♀ with 1 or 2 spots.

α. As *austeni*, larger. ♀ unh with a spot in 1.

cahira bromus, Leech. (42–46). The Colon Swift. W. China, Hong Kong.

β. Comparatively small and pale. Upf spot in 1 usually absent, always present unf. Lower lobe of clasp is produced, but this feature is variable.

cahira austeni, M. (38–42). Sikkim to Manipur. NR. (= *onchisa*, Swin.).

γ. Large and dark. Upf always a spot in 1 in ♂ ; unf the spot is double. Horns on top of tegumen not traceable as separate from the lobes, vertical aspect triangular ; lower lobe of clasp bent right over.

* *cahira sirius*, **nov.** (42–46). Karens to Dawnas. NR.

δ. Small and rather dark. Spots and cilia whiter than usual. Upf no spot in 1, but usually traceable unf. Genitalia as *cahira*.

cahira carna, **nov.** (36–42). Rangoon, Tavoy. NR.

η. Larger and very dark. Upf no spot in 1 or 4 in ♂. Tegumen horns separate from the lobes.

cahira cahira, M. (40–44). Andamans and Nicobars. NR.

ξ. Large resembling *sirius*, but spots are smaller. Upf no spot in 1 and obscure unf. Genitalia as *sirius*.

cahira nirwana, Plotz. (42–46). Siam, Tonkin, Malay Peninsular and Islands. (The smaller and paler Philippine and Celebes form is *jetavana*, Fruh. and *robusta*, Elwes, from Sangir probably is a *cahira* race).

11a (10). Upf upper spot in cell absent or just traceable ; lower spot prominent.

11b (13). Above cilia brown yellow.

11 (12). Wings produced. Upf spot in 4 absent or just traceable ; apical spots absent or a dot in 6 ; obscure spot in 1, which unf is prominent and suffused. Below dark golden brown. Tegumen ending in 4 points.

aurociliata, Elwes. (43). The Yellow Fringed Swift. Sikkim to Manipur. R.

12 (11). Wings broader. Upf spots small, but the spot in 4 and the apical spots 6–8 prominent ; no spot in 1 upf or unf. Unh dark brown, overlaid ochreous brown scales. Tegumen rounded at top.

chimdroa, **nov.** (38), The Abor Swift. Chimdro Valley, Abor Valley (3 ♂, see *B.N.H.S. Journal* vol. xxiii, p. 546).

I. 115. Baoris.—(*contd.*)

13 (11b). Above cilia greyish; dark brown, apex F broadly paler. Unh dark purple brown overlaid dark ochreous scales; apex unf markedly paler brown. Upf spot in 1 absent or just traceable, prominent in ♀; unf always a spot in 1.

cormasa, Hew. (38–40). The Full Stop Swift. Sikkim to Burma, Siam, Malay Peninsula and Islands. R. (= *connasa* Swin. and Fruh. in error; *dravida*, Mab.; *moolata*, M.).

14a (9d). Upf no spots in cell.

14b (16). Unh uniformly overlaid ochreous or greenish scales.

14 (15). Unh overlaid dark ochreous scales. ♂ upf no spot in 1 (rarely just traceable); present in ♀.

α. Large and dark. ♂ unf no spot in 1 or just traceable. ♀ unh no spots. Tegumen top horns insignificant.

kumara lanka, **nov.** (42–46). The Blank Swift. Ceylon. NR.

β. Paler. Unf pale diffused spot 1, sometimes traceable upf. Tegumen top horns short, but conspicuous. ♀ unh usually a spot in 2 and sometimes in 3.

kumara kumara, M. (39–44). S. India to N. Kanara. NR.

γ. Similar but rather darker. Tegumen top horns long, divergent.

kumara moorei, **nov.** (39–44). Sikkim to Dawnas. R.

δ. Smaller, darker; spots on F much yellower; upf no spot in 1 and usually not traceable unf. Tegumen lobe tips and horns equal, prominent; horns not so long as in *moorei*.

kumara malaya, **nov.** (36–40). Mergui, Malay Peninsula. NR. Java (Elwes and Fruh). Borneo (Elwes).

15 (14). Uph overlaid greenish scales. Wings more pointed, ♂ upf always a prominent spot in 1.

α. Large and darker. Unh greenish scales sparse. ♂ upf usually a second spot in 1.

philippina seriata, M. (40–44). The Philippine Swift. Ceylon. NR.

β. Smaller and paler. Unh greenish scales often dense.

* *philippina philippina*, HS. (39–42). S. India, R. Sikkim, Burma. VR. Malay Peninsula, Sumatra, Borneo, Philippines. (? races are *larika*, Pag, Amboina, Moluccas; *mehavagga*, Fruh., Celebes; *subfenestrata*, Rober. Key Is.)

16 (14b). Unh dark brown with a broad purple white central area from dorsum to costa, broken in 1; unf traces of similar colour on the costa. Upf and unf in ♂♀ no spot in 1.

tulsi, DeN. (40–48) The Purple Swift. Sikkim to Karens. NR. Java. (= *jolanda*), (Plotz).

17a (9c) Unh and often uph with prominent pale spots. Upf always prominent cell spots.

Conjuncta Group.

17b (19a). Upf the spot in 2 with its inner edge in line with the outer edge of the spot in the cell or still nearer the termen; always prominent lower and often small upper spot in 1; cell spots separate or conjoined. Above dark brown, basally clothed dark ochreous hairs. Below dark brown overlaid dark ochreous scales. Unh spotting variable up to a maximum of a spot in cell and a discal series 2–5 more or less equal.

17 (18). Uph only prominent elongated spot in 4. Spots white.

* *assamensis*, WM. (50–60). The Great Swift. Central Provinces, Ganjam, Mussoorie to S. Burma, Formosa, S. China, Malay Peninsula. NR. (= *alice*, Plotz.).

18 (17) Uph small round spots in 3 and 4 and sometimes 2; frequently more. Upf spots yellow.

α. Darker. Unh spots comparatively large, complete, and prominent.

* *conjuncta narooa*, M. (45–52). The Conjoined Swift. Ceylon, S. India. R.

β. Paler. Uph spots small and often incomplete.

conjuncta conjuncta, HS. Dun to Burma, Andamans, Nicobars, R. S. China, Annam, Malay Peninsular and Islands, Philippines, Lombok, Banka, Timor, Sumbawa. (= *javana*, Mab. Races are *beraka*, Plotz, Celebes; *stictica*, Fruh., Moluccas. *laraca*, Swin., is probably referable to *conjuncta*; it occurs on Woodlark, Dampier and Vulcan Islands and N. Australia).

I. 115. Baoris.—(*contd.*)

19a (17b). Upf spot in 2 immediately under the cell spot.

19b (21). Unf cell spots completely conjoined and a prominent spot in 1 against v1, spots large. Above dark brown, basally clothed ochreous or greenish hairs. Unh overlaid dark ochreous scales. Uph 3 prominent discal spots, of which the double spot in 4–5 is largest and spot in 3 smallest (may be absent); third spot in 9.

19 (20). Hyaline spots bright yellow; cilia bright yellow; base and dorsum F and dorsal ½ H clothed ochreous hairs. F spots larger; inner edge of spot in 3 nearly touching the outer edge of the spot in 2; spot on 1 elongate oval. Unh dark ochreous, veins obscurely black. Tegumen with 4 horns, lower and outer pair stout and divergent; inner and upper pair slender and nearly parallel.

* *eltola*, Hew. (35–45). The Yellow Spot Swift. Mussoorie to Karens. NR.

20 (19). Hyaline spots white or pale yellow; cilia nearly white; bases clothed greenish hairs. F spots smaller, inner edge of spot in 3 separated by its width from the inner edge of the spot in 2; spot in 1 pyramidal. Unh greenish ochreous, veins not dark. Tegumen ending in a blunt tip, quite different to *eltola*.

α. Larger. Wings more produced. Hyaline spots pale yellow.

discreta himalaya, **nov.** (35–42) The Himalayan Swift. Murree to Kumaon. NR.

β. Smaller. Wings more rounded. Hyaline spots white.

discreta discreta, Elwes. (34–37). Sikkim to Dawnas.

21 (19b). Upf spots small, white, cell spots separate, no spot in 1. Above dark brown, no clothing of ochreous or greenish hairs and H unmarked. Below dark brown, costa and apex F and all H overlaid very sparse ochreous green scales. Unh a discal row of 5 small white spots 2–6, in ♀ only in 2 and 6.

minuta, **nov.** (26–30). The Baby Swift. 2 ♂ Perak, JOR. Camp, 2,000 feet, August 1922. I ♀ Kanbauk, Tavoy, April 1924.

22a (9b). Antennæ short, shorter than v12.

22 (26a). Upf spot in 2 placed well back so as to be under the cell spot or at least so that its inner edge is in line with the outer edge of the 2 cell spots (♀ *contigua* aberrant, but distinguished by the conjoined cell spot).

Pellucida Group.

22c (25). Unh normally with discal row 2–6 and sometimes obscure spot end cell; at least spots in 4 and 5 present.

22d (24). Upf always a spot in 1.

22 (23). Upf cell spots separate. Uph a complete series. Above bases clothed dark greenish hairs. Unh overlaid greenish ochreous scales. Wings broad.

pellucida, Murray. (40). The Pellucid Swift. Japan and China (= *quinquepuncta*, Mab.).

23 (22). Upf discal spots conjoined. Uph and unh very variable, complete series may be present or only spots in 4 and 5. Above brown, overlaid ochreous hairs. Below overlaid ochreous brown scales. Wings more pointed. H v7 opposite v2.

* *contigua*, Mab. (36–42). The Contiguous Swift. S. India. Kumaon to Burma. China, Formosa, Siam, Tonkin, Malay Peninsula and Islands, Bali, Lombok, Sumbawa, Celebes. (= *toona*, M. and *scortea*, Mab.)

24 (22d). Upf no spot in 1 or upper cell spot; spots in 2, 3 and 4 elongated to bases of their interspaces. Uph discal spots in 2–5 elongate and prominent. Above brown, overlaid ochreous scales and all spots yellow; below similar, paler.

amalia Semp. (30) The Australian Swift. N. Australia. (= *fulgidus*, Miskin and *sigida*, Mab.)

25 (22c). Unh only spots in 2 and 3 of which that in 3 appears above. Upf spot in 4 absent and spot in 1 small; apical dots in 6 or 6 and 7; cell spots separate. Above dark brown, heavily overlaid ochreous hairs. Below overlaid bright ochreous green scales, rendering spots unh difficult to see. Wings produced.

. **115. Baoris.**—(*contd.*)

bipunctata, Elwes. (40–44). The Moluccan Swift Batjan, Moluccas. (= *sidata*, Fruh, Buru ; ? *contigualis* Roth., New Guinea).

26a (22b). Upf spot in 2 not before the origin of v3 and well in front of the cell spots, if latter are present. Never with the yellow appearance of the last group.

Guttatus Group.

26b (31). Upf spots in 2, 3 and 4 equidistant and never a spot in 5.

26c (29a). Unh normally discal spots in 2 5 or 6 and at least spots in 4, 5 present. Upf no spot in 1.

26d (28). Uph unmarked Unh spot in cell against upper edge and discal series 2–6.

26 (27). Upf 2 prominent spots in cell. Above rather pale brown ; below similar, more or less overlaid ochreous green scales. Unh spots white.

jansonis, But. (40). Janson's Swift. Japan, Corea.

27 (26.) Upf single upper spot in cell or none. Above dark brown and spots white. Unh dark ochreous and spots pale shining purple.

coerulescens, Mab. (44). The Bluespot Swift. W. China.

28 (26d). Uph marked as unh. Upf no spots in cell (very rarely 2 are traceable). Above dark brown. Below apex and costa F and all H densely overlaid pale greenish scales. Unh normally only spots in 2–5, but occasionally a spot in 6 and in cell are traceable.

α. Large. Uph discal spots in a straight decreasing row

* *guttatus guttatus*, Brem (34–40). The Straight Swift. Chitral to Assam, Hills 2–9,000 feet. China and Japan. C. (=*fortunet*, Fd.; *mangala*, M. and *cinnara*, Wall, Formosa).

β. Small. Uph and unh spotting very variable, discal row may be as in *guttatus* or curved and irregular.

guttatus bada, M. (32–36). Ceylon, India, Burma, C. China, Hainan, Formosa, Tonkin, Siam, Malay Peninsula and Islands, Philippines, Celebes, N. Australia. (= *philino*, Mosch ; *haga*, *sifa*, *intermedia*, *nondoa* and *kolantus*, Plotz ; *quinigera*, M.; *apostata*, Snell ; *philotas*, DeN.)

29a (25c). Unh no spots in 4 and 5. Below apex and costa F and all H more or less overlaid pale greenish ochreous scales.

29 (30). Unh with a broad pale central fascia, caused by the greenish ochreous scales being rather denser there ; normally decreasing white spots in 2 and 3, which do not appear uph. Upf 2 prominent cell spots ; ♂ without, ♀ with spot in 1, present unf. Above brown, bases and most of H clothed obscure greenish hairs.

canaraica, M. (42–44), The Kanara Swift. S. India. R. (= *flexilis*. Swin.).

30 (29). Unh uniformly overlaid dense greenish ochreous scales. Very variable. Upf cell spots present or absent, always a spot in 1. Unh usually white spots in 2, 3 and 6 ; usually the spot in 3 appears upf.

α. Generally paler.

zelleri zelleri, Led. (30–36), The Rice Swift. Syria, N. Africa.

β. Generally darker.

* *zelleri colaca*, M. Ceylon, India, Burma, Andamans, Nicobars, C. Formosa, Hainan, Malay Peninsula, and Islands, Philippines, Moluccas, N. Australia (= *cingala* and *hainana*, M.; *saturata*, WM. and DeN. ; *distictus*, Holland ; *saruna*, *daendali* and *urejus*, Plotz & ? *ogasawarensis*, Matsumura, Bonin Is.).

31 (26b). Upf spot in 3 nearer spot in 2 than spot in 4, usually a spot in 5 ; only an upper spot in cell, which may rarely be absent. Above rather pale brown. Below apex and costa F and all H closely overlaid pale greenish ochreous scales. Unh small white spots in 2–6, those in 4 and 5 often absent ; these spots appear uph more or less obscurely.

α. Upf no spot in 1.

bevani thyone, Leech. (30–36). Bevan's swift. C and W. China, Formosa.

β. Upf ♀ with a spot in 1 ; in ♂ present or absent.

* *bevani bevani*, M. Ceylon, India, Burma, Andamans, Nicobars, C. Malay Peninsula and Islands, Philippines. (=*vaika*, Plotz.) (I have been unabie to place the following ; —*repetita*, But. New Lauenburg ; *albiclavata*, But., New Pomerania and Georgia ; *cretura*, Plotz, Celebes ; *unicolor*, Dist., Malacca ; *yanuca*, Fruh., Formosa ; *palawanica*, ? figured in Seitz ; *impar*, Mab Australia or Oceania).

I. 116. Gegenes. (Plate 32.) The Dingy Swift.

Above very dark to very pale brown in desert areas. ♂ normally unmarked above, but in pale specimens the spots from below may show through; in ♀ upf the spots from below always show through. Cilia dusky grey. Below costa and apex F and all H clothed grey scales. Unf in ♀ complete row of discal whitish spots, 2 in 1 (upper small and against outer edge or lower spot), in 2 and 3, small in 4 and 5, apical 6–8; in ♂ the spots are reduced and the spot in 1 is rarely traceable. Unh a discal row of obscure small grey white discal spots in 1–5 and a spot in 6 further from termen.

* ***nostrodamus***, Fab. (28–35). Baluchistan, Sind, Punjab, Chitral to Kumaon. NR. S. Europe, N. Africa, W and C. Asia. (= *pygmæus*, Auct in error; *pumilio*, Hoff; *lefebvrei*, Ramb.; *karsana*, M.,—the desert form).

I. 117. Eogenes. The Torpedo. (Plate 32).

Above brown, cilia grey; semi-hyaline spots on F only, double spot in cell, discal row pointing to apex, consisting of double spot in 1, in 2 and 3 (coalesced in ♀), small dots in 4 and 5 (often absent), conjoined apical spots in 6–8 Below brown, apex F and all H overlaid grey scales leaving on H obscure pale centred dark spots in 1, 2, 3 and 5 Unf the scales on the basal ¼ erect, rough looking.

* *alcides*, HS. (38–44). Chitral, NR. Asia Minor, Armenia, Buchara, Karategin. (= *ahrimani*, Christoph.)

(*The end.*)

A SUMMARY OF SCIENTIFIC RESEARCH IN THE PERSIAN GULF

BY

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"It is the glory of God to conceal a thing; but the honour of Kings is to search out a matter." *Prov. XXV. 2.*

As remarked by Lord Curzon, in his classic work on Persia, Great Britain appears to have been unpardonably slack in promoting scientific enquiries in Persia generally, and especially in the Persian Gulf and in South Persia; the vast hinterland of Oman and of the Arabian Coast still remains virtually unexplored: instead of making use of our position and of the unequalled resources of the topographical and geological survey departments of India to make a thorough examination of the hinterland of both coasts, we have left this task for the most part to chance travellers, with the result that great areas are still almost as unknown as they were to Nearchus. The marine and terrestrial fauna, the flora, and the geology of this region have never been systematically studied, as they should have been, by the highly competent experts available in India. Nor can we altogether congratulate ourselves on the extensive survey that has been made of the Gulf itself, for it is still no unknown occurrence for a ship to strike an uncharted rock, and a recent explorer (Captain R. E. Cheesman) has shown that the Admirality Chart of the Arabian Coast south of Bahrain island is very inaccurate.[1] A complete re-survey of the Gulf is, in fact, overdue.

Yet hundreds of Englishmen, many of them with scientific tastes, live and work in this region and it is within the power of nearly all of them to contribute something to the world's stock of scientific knowledge regarding this often traversed, but little studied, corridor.

The writer has endeavoured to summarize below the principal directions in which scientific research in the Persian Gulf has proceeded during the past fifty years, in the hope that some residents in, and visitors to, this region may be encouraged thereby to take up one or more of the fascinating byways of science; no reference has been made to the earlier literature of this region, in which was embodied the learned speculations, and the excursions into fairyland of successive generations of writers, whose critical faculties, if they ever possessed any, were not seldom overwhelmed by the romantic atmosphere of the East. Whatever is of permanent value in their speculations has, for the most part, been confirmed by subsequent labourers in the same field, and has been embodied in their published works. It will be seen that there are many persons who have contributed numerous original memoirs, all of them of some, but perhaps none of extraordinary, importance. These men had the capacity of making a striking discovery, though they had not the luck to do so. Their work is valuable and remains, but the worker is forgotten.

ARCHÆOLOGY AND ANTHROPOLOGY:

The pioneers in the systematic examination of sites in the Persian Gulf region were Englishmen, of whom the most celebrated were Layard, Rawlinson and Loftus: between 1836 and 1861, but especially between the years 1845 and 1850, they attacked sites in Assyria, Babylonia and Susiana. They were, however, very inadequately supported by the British Government, and not at all by the Government of India, and it was not long before their labours were supplemented and finally supplanted by the expeditions of Texier, of Flandin and Coste, of Dieulafoy (1885-6) and De Morgan. The researches undertaken by these distinguished *savants*, especially at Persepolis and Susa (where nothing had been done since the British operations in 1852), have been given to the world in a series of splendid and sumptuously illustrated volumes. In 1895, a monopoly of antiquarian research in Persia was obtained by France and, under it, operations at Shush were renewed in 1897 by M. de Morgan. His successors, Maurice Pézard and Count R. de Mecquenem, have also published during the last fifteen years memoirs of importance dealing respectively with the earliest historical remains at Bushire, and with subsequent developments at Susa, while M. Paul Toscanne of the Louvre has edited a series of valuable monographs on special points arising from the investigations of his French confrères. Dr. Herzfeld, a German archæologist, has, quite recently (1924) re-examined Persepolis, and has brought to light here, and at a newly discovered site in the Mamasani country, sixty miles west south-west of Shiraz, several important inscriptions; he has submitted to expert examination, for the first time, the early burial caves and rock carvings on Kharag Island which he has demonstrated to have been occupied by a Christian community as early as the third century A.D. Dr. J. Theodore Bent visited Bahrain in 1889 and commenced excavations in the hope of elucidating the riddle of the vast assemblage of burial mounds there, which he ascribed to the Phoenicians: these had already been reported on by Capt. Durand in 1880: some further excavations were undertaken in 1906-7, at the instance of the Government of India, by Major (now Lt.-Col.) Prideaux, the Political Agent, but with inconclusive results.* Further investigations were made in 1924 by Mr. E. MacKay, no report of which has yet been published.

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[1] From Oqair to the Ruins of Salwa, *Geog. Jour.*, 1923, November.

Dr. Hogarth's book on Arabia summarizes in convenient form what little is known of the archæology and anthropology of Arabia, and Professor Myres, in the opening chapter of the *Cambridge Ancient History,* has made the most of the very scanty material available, and restated the position in this respect,[1] so far as known to us, in a series of brilliant generalisations. But, if we except Bushire, Susa and Persepolis, scarcely a beginning has yet been made in this surely most remunerative field. Oman is still untouched by the spade, though extensive ruins with numerous inscriptions are said to exist only five miles west of Sohar: the ancient towns of Sur, Dhufar and Kalhat, to mention only three, have never been examined by an archæologist; Gerrha, Qais, Siraf, and many other ports have yet their secrets to yield, and I do not doubt that whoever ultimately has the privilege of undertaking this task will reap a rich harvest.

BOTANY :[2]

Our earliest authorities are Pythagoras, Demochitus,[3] Theophrastus and Dioscorides but, excluding these and the incidental references to botanical subjects containing in early printed books, the first serious attempt to collect and classify botanical specimens from the Gulf region was made by Aucher Eloy and published in his *Relation de Voyages en Orient de 1830 à 1838* (Paris 1840). In the same year Antonio Bertoloni published an account of the plants obtained by the Chesney Expedition, in *Miscellanea Botanica,* ii, *Novi Comment. Acad. Sci. Instit. Bonon.*

Major H. A. Sawyer was at pains to make as complete a collection of plants and shrubs as possible during his journeys in the Bakhtiari country in 1889-91, and the notes of the Curator of the Royal Botanical Society on the collection are printed as an Appendix to his report,[4] which is available for students in India Office Library: a few years previously O. Stapf had published, in 1886, in the *Botanisches Centralblatt,* 1886, xxvii, pp. 211, 243, 275, a paper on *"Vegetationsbilder aus dem Sudlichen und Mittleren Persien."*

Some valuable botanical notes were made in 1893 by Leo Hirsch (*"Reisen in Sud Arabien, Mahraland und Hadramaut,"* Leiden, Brill. 1897), and, subsequently, relating to the same area, by Dr. J. Theodore Bent, "Exploration of the Frankincense Country, S. Arabia," *Geog. Jour.,* 1895, vi, p. 133. See also J. G. Baker, "Botany of the Hadramaut Expedition," *Kew Bulletin,* 1894, p. 328, and 1895, p. 315.

Major (now Lt.-Col.) S. G. Knox, Political Agent at Kuwait, made a

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*The Sepulchral Tumuli of Bahrain—See *Archæological Report of India,* 1908-9.

[1] Omitting, however, any reference to tumuli at Bahrain.

[2] With acknowledgments to Mr. R. D'O Good, Brit. Mus. Nat. Hist.

[3] Pliny, Lib. xxv, Chap. vi.

[4] Report of a Reconnaissance in the Bakhtiari country, South-West Persia, Simla, 1891.

careful collection of desert shrubs found in the Zor hills in the hinterland of Kuwait. These were examined by H. G. Carter of the Botanical Survey of India, whose report on each specimen, with the Arabic name attached, was published by the Government of India, *Records Botanical Survey of India*, vi, p. 175, 1912. In the same series (Vol. viii, No. 1, 1919) is published *"Flora Arabica,"* by that well-known authority Father E. Blatter. The student should also see Mrs. Bishop's *Journeys in Persia and Kurdistan*, vol. i, p. 290 *et seq.*, and preface, p. viii, 1891. Some further information on this subject is contained in Philby's *Heart of Arabia*, 1922, ii, p. 309, and in an appendix to Floyer's *Unexplored Baluchistan*, 1882; and much of Ainsworth's Botany of the Afghan Boundary Commission, 1887 (from *Trans. Linnæan Soc.*, Series ii, vol. iii) applies to Persia.

Mesopotamian flora were specially dealt with by Emilio Chiovenda, "Contributo alla Flora Mesopotamia-Malpighia," xiv, 1900, and Buxton's *Animal Life in Deserts*, 1924, contains some useful information on the distribution and habits of desert plants.

These reports and contributions represent the sum total of our knowledge of the systematic botany of this region, and a fruitful field of research awaits any resident who has the energy to take up this inexpensive and interesting hobby.

ETHNOLOGY:

Duhousset (*Etudes sur les populations de la Perse et pays limitrophes pendant trois années de séjour en Asie*, 1863) and Nicolas de Khanikoff (*Memoire sur l'Ethnographie de la Perse*, Paris, 1866) are our first and, perhaps, our best authorities, followed by De Morgan and Tomaschek. See also *The Cambridge Ancient History*, vol. i.

GEOGRAPHICAL SURVEYS:

The geographical surveys, executed by the Chesney Expedition and by officers of the Indian Navy in Mesopotamia and Arabistan in the first half of the nineteenth century, combined with the marine surveys between 1820-8 of Brucks and Haines, Constable and Stiffe, and other officers of the Indian Navy along the littoral, which were checked wherever facilities existed for ascertaining longitude by telegraph, formed a useful framework on to which subsequent work was grafted and embodied in successive editions of the standard maps produced by the Survey of India; much original work, however, was lost by the carelessness and indifference alike of the Government of India and of His Majesty's Government. The valuable work of the Turco-Persian Commission, in 1850 and the succeeding years, never seems to have been incorporated in published maps, no copies having been transmitted to the Government of India by His Majesty's Government; and no serious attempt seems to have been made until after the Persian War in 1856 by the military or survey authorities in India to collate the observations of numerous travellers or to encourage the preparation of reconnaissance reports or the correction of existing maps.

The *Geographical Memoir* of Capt. Macdonald, afterwards Sir J. Macdonald Kinneir, British Minister in Persia, published in 1813, and supplemented later by a further publication,[1] for some time enshrined the corpus of available geographical knowledge of the country; to which important additions were made by several English or Indian officers, notably Grant, Pottinger, Christie and Monteith who, like Kinneir, came to Persia with Sir John Malcolm. In 1840, De Bode filled in some empty spaces in existing maps, though he made no attempt at systematic exploration. After him came Major (afterwards Sir Henry) Rawlinson, whose topographical researches, when employed as an officer in the service of Muhammad Shah, were of outstanding merit and covered very extensive areas in South-West Persia.[2] Sir H. Layard, a not inferior name, also most fortunately devoted to South-West Persia, including

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[1] *Journey through Asia Minor, Armenia and Koordistan*, 1818.

[2] Notably by his "Notes on a March from Zohab . . . to Khuzistan (Susiana)," and thence through the Province of Luristan to Kirmanshah, in the year 1836. (*J.R.G.S.*, 1836, January.)

Arabistan, Pusht-i-Kuh and the Lower Bakhtiari country, those gifts of insight and of style that have rendered him famous.

The surveys undertaken by Sir F. Goldsmid in Persia and in connection with the settlement of the Perso-Baluch frontier between 1870-2 also resulted in a very considerable addition[1] to our knowledge of Persian conditions and of the geography of South-East Persia and the Persian Gulf. The construction of a telegraph line from Bushire *via* Tehran to Khanikin by the British Government in agreement with the Persian Government resulted in a number of detailed surveys between 1860 and 1862, by officials[2] of the Telegraph Administration under the orders of Lt.-Col. Patrick Stewart and Major Bateman Champain.[3] In 1863 a telegraph line was constructed from Karachi to Gwadur through States of Kalat and Las Bela to Gwadur and subsequently to Jask. The surveys for these lines, and the telegraphic determination of longitudes at various points covered South and Central Persia with a network of route surveys punctuated by accurately determined points, and resulted in the publication in 1873-4 of Capt. O.B.C. St. John's Map of Persia, 16 m. = 1 inch, in six sheets "compiled principally from original authorities, by order of His Majesty's Secretary of State for India".

This was one of the most valuable maps of Persia ever made. Sir O.B.C. St. John joined Lt.-Col. P. Stewart's expedition to Persia in 1863, for the purpose of establishing telegraphic communication from India to the Bosphorus. His own duties lay in the Persian section, and he was in charge of the last telegraphic division, which was, at the same time, the most important and the most difficult. Later, he superintended the construction of the line from Tehran to Bushire. In 1871 he went to Baluchistan as Boundary Commissioner of the Perso-Kalat frontier, and completed the survey of that boundary. On his return to England he was employed on special duty at the India Office, during 1873 and 1874, in compiling this great map of Persia and Persian Baluchistan. The map was based on longitudes of the principal Persian telegraph stations, fixed in co-operation with General Walker of the Indian trigonometrical survey, Capt. W. H. Pierson, R.E., and Lieut. Stiffe of the Indian Navy, by whom time-signals were exchanged between Greenwich and Karachi on the one hand, and stations in Persia on the other.

Twenty years later, officials in the Persian Gulf were encouraged by Lord Curzon to undertake a series of investigations along the Persian Gulf littoral. The late Mr. J. G. Lorimer made extended investigations along the Arabian littoral: Capt. (now Sir P. Z.) Cox who, in 1901 and 1902, had made important additions to our knowledge of Oman,[4] examined the Persian littoral from Dilam to Qubban in 1905 and, in Oman, travelled by land from Ras al Khaima to Sohar *via* Baraimi, a route which had been traversed in the opposite direction and sketched by Capt. Hamerton, in 1840.[5] In the same year, Capt. (now Lt.-Col.) S. G. Knox, visited Hafar, a famous landmark in the interior, distant 160 miles from Kuwait, which, though mentioned by previous European travellers in Arabia, had not been reached by any of them. In this field he was brilliantly followed by the late Capt. W. H. I. Shakespear and the late Lt.-Col. Leachman, and the late Miss Gertrude Bell. Lt.-Col. Burton and Capt. (now Lt.-Col.) Lorimer made a number of most productive journeys in Arabistan which were extended in subsequent years to Pusht-i-Kuh by the former, and to the same region, Luristan and the Bakhtiari country by the latter.

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[1] See *Telegraph and Travel,* Goldsmid, 1874, a well written and well illustrated book which deserves to be much better known.

[2] An outstanding example is E. A. Floyer of the Indo-European Telegraph Department whose book *Unexplored Baluchistan* (1882) is still a useful work of reference though he travelled in 1876-7.

[3] The late Sir Henry Mance, who died at Oxford in April 1926, was the inventor of the heliograph: as a young man he was employed by the I.E.T.D. in the Persian Gulf, where the soldiers of Alexander the Great are said to have signalled by flashing the sun from their shields. It was in developing this idea that he invented the heliograph.

[4] See Overland Journey from Maskat to the Persian Gulf, *G. J.* 1902, xx, and Some Excursions in Oman, *G. J.,* 1925, Sept.

[5] See marginal note to "Map of Maritime Arabia," Bombay Selections, xxiv, 1856.

The latter tract, which, with the possible exception of the Aoraman Range of Central Kurdistan, is the most lofty and inaccessible part of the great Zagoros chain, had been very thoroughly explored in 1889 by Major H. A. Sawyer of the Bengal Staff Corps, assisted by Indian surveyors: his maps and reports, though amplified in places by subsequent explorers, notably by McSwiney (1891) in the south, Capt. Lorimer (1903-8), Capt. Ranking (1909-11), and Capt. Noel (1915-17), are and will long remain classic authorities.

The explorations of Major (now Sir P.) Sykes are too well known to require detailed reference here: they were supplemented, under his instructions, during the war, by several valuable detailed surveys, especially in Fars.

Nor must we omit to mention the valuable and varied information on geographical and scientific topics collected by De Morgan and published in 1895 in his *Mission Scientifique en Perse.* In this work, attention was for the first time prominently drawn to the *bande pétrolifère* stretching south-east from Kirkuk, in which De Morgan considered might be found the most important source of wealth throughout the whole region; and the possibility of a pipe line from Khanikin to the Mediterranean was for the first time mooted and discussed, as also the proposal for a Baghdad-Tehran railway. Had De Morgan followed up his views on this matter in South-West Persia, the history of the oil industry might have been different!

The fruits of the labours of these and of many other travellers, official and unofficial, were embodied by the Survey of India in a succession of standard sheets, first on the 8 m. = 1 inch scale (and later in $\frac{1}{4}$ inch sheets, a complete series of which, covering the whole of Persia now exists, and is constantly, though all too slowly, under revision. For general purposes, the Survey of India have published at intervals since 1875 successive editions of St. John's map referred to above on the 16 m. = 1 inch scale, which has now been replaced by the corresponding sheets of the International Series on the scale of 1 million and by sheets on the $\frac{1}{2}$ million scale. The 1 million sheets covering the northern part of the Arabian peninsula embody, in addition, the vast mass of material gleaned previous to 1910 from native information,[1] to which most important accessions have since been made by the late Lt.-Col. G. E. Leachman, the late Capt. W. H. I. Shakespear, Mr. H. St. J. Philby, Major R. E. Cheesman and others and, since the Armistice, between Baghdad and Jerusalem and Damascus, by the devoted labours of Major A. E. Holt.

It may fairly be said that in the matter of maps, no part of the world, not forming part of the British Empire, has been better served by British topographers, but the gaps in our knowledge of local geography are still many, and serious. Oman is still to a great extent unknown; the immediate hinterland of the Trucial Oman has never been explored; Musandam has not yet yielded all its secrets; we still await a survey of the Hasa littoral. On the Persian side of the Gulf, not only are there still some blank spaces to be filled, notably in the Kuhgilu Hills and the Mamasani and Boir Ahmadi country, but the utility of existing maps is diminished in practice by the conditions under which they have been compiled, and from the absence of a proper system of triangulation, so that, in many cases, they cannot be relied on off the main routes. Had the money, which has been devoted from time to time to particular surveys, and to the extended journeys of individual consular and military officials, been spent on a well thought out survey programme covering a period of, say, twenty years, we should have, by this time, a complete and accurate survey of both sides of the Gulf on the $\frac{1}{4}$ inch scale, in the light of which much that has been written on the subjects of roads and railways in Persia would have to be reconstructed. The writer states this conclusion with the less hesitation because, though his own travels have never extended to the Arabian Peninsula or to Persia east of a line drawn through Bandar Abbas, Shiraz, Isfahan and Tehran, it has been his good fortune to travel very extensively, both as a private person and on Government and commercial affairs, in West and South-West Persia, and in Iraq, between 1907 and the present day. He has himself surveyed, in South-West Persia, some hundreds of square miles with a plane table, and has had the opportunity of checking, on the spot, the work of Indian surveyors, amongst them those distinguished members of the Indian Survey Department, Khan Bahadur Yusuf Sharif and his friend Khan Bahadur Shir Jang, C. I. E., an Afghan by origin, who, in 1905, surveyed the vicinity of Muscat, the Bahrain Islands, and the country surrounding the Bay of Kuwait. The writer has traversed, on foot or on mule or horse-back, almost every main road in South-West Persia and, in the course of many years, has visited almost every place of importance in Arabistan, Luristan, Pusht-i-Kuh, Bakhtiaristan and Fars. As Deputy British Commissioner and, subsequently, British Commissioner for the delineation of the Turco-Persian Frontier he visited every town and settlement on both sides of the boundary from Fao to Ararat, and climbed almost every pass across the Zagros Range, between the two countries.

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[1] Including the work of Huber, Wallin, Palgrave, Doughty, etc.

In various capacities, during and after the Great War, it fell to him to visit every town in Iraq, by road and by air, and to discuss with successive Directors of Surveys, more particularly Lt.-Col. C. H. D. Ryder, afterwards Surveyor-General of India, and Lt.-Col. Pirrie of the same service, ways and means for a complete topographical and cadastral survey from Basra to Mosul. These discussions demonstrated how much time and labour and consequently money can be, and generally is, wasted on independent regional surveys, unless the preliminary work of triangulation has been carefully done, and unless a carefully thought out plan has been previously made and then adhered to.

The immense amount of fruitless discussion, time and money that has been lavished at various times in connection with the Perso-Baluch and Turco-Persian frontiers would also have been saved, and the British, Russian, and neutral zones of 1907 would, in the light of fuller geographical knowledge, perhaps have been more intelligently drawn, to the advantage of international peace and friendly relations.

MARINE AND RIVER SURVEYS

Charts of a kind for the guidance of vessels in the Gulf already existed in 1785 and these, Lieut. John McCluer, a self-taught surveyor of the East India Company's Marine, had devoted himself assiduously to correcting during a period of three years' service in the Gulf, the result of his voluntary labours being a chart of the whole north-eastern side of that sea and of the Shatt-al-Arab up to Basra, accompanied by a memoir, besides plans of the harbour of Muscat, Basra, and other ports.[1]

The south-western or Arabian shores of the Gulf, however, remained for the most part practically unknown; and in 1810, when giving the commanders of the British Expedition against the Qawasim detailed instructions for the visitation of piratical ports, the only map which the Government of India could supply was a "topographical sketch" by one Saiyid Taqi, showing roughly the positions of eight or nine piratical places to the south-west of Ras al Khaima.

In 1811 a surveying officer was placed on board the East India Company's cruiser *Benares* in the Persian Gulf, but the nature of the duties on which the vessel was employed made systematic operations by him impossible. Towards the end of 1815 orders for a regular survey were issued by the Court of Directors of the East India Company, but danger from pirates made their execution impracticable.

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[1] McCluer in the course of his progress made drawings of various parts of the coast to facilitate the navigation and wrote useful directions for the same purpose. These were used by the hydrographer of the East India Company, Mr. Alexander Dalrymple, who died in 1808. A chart of the Persian Gulf was compiled by the Admirality in 1820, from the surveys of McCluer and other officers of the Bombay Marine.

A writer, reviewing, in 1829, the hydrographical work of McCluer, says: "When the works of an individual are carefully preserved and consulted as a standard authority by those who survive him, it is a sufficient proof of their excellence, . . . Those of Lieut. McCluer have stood the test of nearly forty years; the considerable addition they formed to the stock of hydrographical information, justly entitled their author to the acknowledgements of the maritime world; and at this distance of time we readily bestow our tribute to the memory of a man who has perpetuated his name by his valuable works. His first essay in the Persian Gulf, which alone proceeded from a desire of benefiting navigation, was a fair promise of the zeal which he afterwards displayed in the survey of the coast of Hindostan."

In 1817, a memoir on the ports and pearl banks of Bahrain, together with surveys, was prepared by Lieut. Tanner of the Bombay Marine; but it was not until 1820, on the conclusion of the third expedition against the Qawasim, that a proper survey of the south and west waters of the Gulf, beginning at Ras Musandam, was undertaken by Capt. P. Maughan in the *Discovery,* assisted by Lieut. J. M. Guy in the *Psyche.* Lieut. Guy succeeded to the direction of this survey in November, 1821, and he had carried his operations as far as the promontory of Qatar when, in February, 1823, his place was taken by Lieut. G. B. Brucks. Lieut. Brucks completed the survey of the Arabian Coast, which occupied him until 1825; and early in 1826 he began work on the Persian coast and islands, to which the following ten years were devoted. In 1828 operations were begun in the Gulf of Oman under his command, and were continued by Lieut. S. B. Haines, who finished the Makran coast to Karachi in 1829: the Oman side had previously been completed down to Muscat. The first marine survey of the Persian Gulf, partly from the smallness of the vessels employed, was a most arduous and painful service; and a lamentably large proportion of the officers employed on it either died or broke down in health from the effects of climate and hardship.[1]

In 1835, an expedition under Col. F. R. Chesney left England for Turkish Arabia to make an experiment—for which the permission of the Porte had been obtained, and for which the British Parliament had granted £20,000, and the East India Company £5,000—in the direction of introducing steam navigation upon the Euphrates. Two river steamers were launched upon the Upper Euphrates in the course of 1835-6; but one of them, the *Tigris* was unfortunately lost in a storm within a few weeks after her completion: the remaining vessel, the *Euphrates,* navigated on the rivers Euphrates, Shatt-al-Arab, and Tigris, of which surveys were made, during the rest of the year; but in December the expedition was broken up, and the *Euphrates* was transferred on a valuation from the British Government to the East India Company. The experiment, in so far as it related to the establishment of rapid and certain communication between England and India cannot be described as a success; but Col. Chesney's surveys of the Euphrates, Tigris and Karun mark an important step in geographical progress: his chart of the Shatt-al-Arab, from Basra to the bar inclusive, is of particular interest, as showing the changes that have taken place during the last hundred years in this region.

The land and river surveys initiated by the Chesney Expedition were continued with great energy during more than twenty years by the officers of the Indian Navy employed with the British Mesopotamia flotilla, or the stationnaire of the Baghdad Political Agency; they extended to Arabistan and elsewhere, and to the confines of Persia with Iraq.

Commander Lynch (1837-43) surveyed the Tigris from Mosul to Ctesiphon, the Euphrates below Masharrah, and connected Niniveh, Baghdad, Ctesiphon and Babylon by triangulation. Lieut. Campbell (1841-2) surveyed the Tigris below Baghdad; Commander Felix Jones (1843-54) surveyed Zohab, the old Nahrwan Canal, the old course of the Tigris above Baghdad, and the Persian hills from Baghdad to Mosul. He also made a survey of the country from Musaiyib to Najaf the material of which was lost in the India Office, as also was that of a survey by Commander Selby (1841-2 and 1856-61) from Babylon to Samawa; a valuable chart of the Shatt al Arab from Basra to the sea, by Commander Felix Jones and Lieut. Collingwood, met with a similar fate. Selby also surveyed the Karun River with its branches and affluents.

A survey of the south-east coast of Arabia, begun by Capt. Haines in 1833, was discontinued in 1837 owing to the exigencies of the service; and from 1839 to 1844, in consequence of the war in Afghanistan and want of money for general purposes, marine surveys by the Indian Navy were almost entirely in abeyance. In 1839, however, perhaps in connection with the occupation of Kharag, a report on the harbour of Kuwait was made by an officer of the Indian Navy. The survey of the south-east coast of Arabia was resumed in 1844 and completed in 1848. In 1857, it having been decided to revise the

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[1] Further, it must not be forgotten that surveying was but a small part of the work of the Indian Navy and that the operations were carried on only when other duties of watch and ward, such as the hunting down of pirates and the suppression of the slave trade, permitted.

Persian Gulf Survey of 1820-8, in which errors and omissions were known to exist, Captain C. Constable, assisted by Lieut. A. W. Stiffe, was appointed to carry out the work. He completed it in 1860, and the result of the labours of the two officers was a general chart of the Persian Gulf in two sheets, of which the essential features were reliable, but which Capt. Constable himself described in 1862 as not being on nearly large enough a scale. Meanwhile a survey of the harbour of Bahrain was made by Lieut. Whish, I.N., in 1859.

At the end of 1862, the vessels of the Indian Navy serving in the Persian Gulf were recalled to India. On April 30th, 1863, the Indian Navy ceased to exist. It was understood at the time of the change that the duties performed in the past by the ships of the Indian Navy would devolve in future on those of the Royal Navy; but some years elapsed before a practical method of working with the substituted force was devised and, in the interval British political interests suffered severely in the Persian Gulf, the Red Sea and elsewhere. For ten years and more no fresh surveys were undertaken, and many original drawings and memoirs, the fruit of expensive surveys, were lost. In 1871 the Government of Bombay, having awakened to the necessity for new surveys, consulted Col. Pelly, and a general discussion of the subject was initiated, the upshot of which was that Mr. Girdlestone, formerly a midshipman in the Indian Navy, was deputed to the Persian Gulf from 1871 to 1874 to make a survey of Bahrain and Qatar waters: the survey was extended towards the mainland, not without some opposition on the part of local Turkish authorities who were, however, over-ruled by the Wali of Baghdad. In 1876, the inlet of Khor-al-Hajar on the coast of Oman was surveyed. In 1886, the inlet of Khor Bani Bu Ali was discovered by a British naval vessel and, in 1888, the Bahmanshir was partially examined, in connection with the opening of the Karun River to navigation in the same year.

In 1890, the approaches of the Shatt-al-Arab and Bahmanshir from the sea were surveyed by British vessels; with the assent of the Persian Government the Bahmanshir was examined and sketched in the same year and its impracticability for ocean steamers demonstrated. By permission of the Shah and of the Sultan of Oman, British tidal observation stations were established at Bushire and Muscat in 1892 and 1893 and, in 1894, telegraphic observations were undertaken at the Bushire and Jask telegraph stations with a view to the determination of longitude.

In 1901, a fresh survey of the approaches to Bahrain and the Manamah harbour was made. These isolated surveys were, however, of little practical value, and it was not until Lord Curzon's viceroyalty that any active steps were taken to continue and extend the surveys of the old Indian Navy: thirty valuable years had been lost. Bushire harbour was re-surveyed in 1903, with the consent of the Persian Government, though they intimated that, whatever the result of the investigations, they would neither deepen the harbour themselves nor permit it to be deepened by the Government of India. As a matter of fact, the soundings showed that the deepening of the inner anchorage and the approach to it from seawards for ships of heavy draft would be of little use so long as the bar of the Shatt-al-Arab continued to regulate the size of vessels employed in the Persian Gulf, but that the dredging of a channel for vessels of moderate size from the inner anchorage to the wharves on Khor Sultani would be an advantageous and, probably, not a difficult operation. In 1904, Kuwait harbour was re-surveyed, the work not being completed until 1907, and not without violent protests from the Turkish Government. In 1904-5 H.M.S. *Redbreast* made a detailed examination of Khor-al-Qalaiya of Bahrain Island, which, it was hoped, might afford superior harbour facilities to those of the exposed anchorage off Manamah: the results, however, were negative.

In 1905-6, the R.I.M.S. *Investigator* was again employed in the Gulf, and completed the surveys of the mouth of the Shatt-al-Arab, the approaches thereto, and the port of Kuwait. In 1906 the Marine Survey of India carried out surveys of the Khor Abdullah and of the Khor Zubair from its source.

From this date until 1910, no surveys were undertaken in the Gulf, but, at the latter end of this year, R.I.M.S. *Palinurus* was recalled from her survey work on the west coast of India, and despatched up the Gulf to re-survey the mouths of the Shatt-al-Arab. Again the Turkish authorities placed every obstacle in the way of this survey, refusing permission to land a party at Fao for observations of the rise and fall of the tides and, on several occasions, cut adrift the moored beacon buoys that were used.

Then, until the Great War, 1914, the *Palinurus* was employed continuously in the Gulf and completed the following surveys :—

1911-12. The approaches to the Shatt-al-Arab, as far as Kubbar Island.
1912-13. The approaches to Bahrain harbour; a plan of Bandar Abbas; and of Hanjam Sound.
1914. Clarence Straits.

During the Great War, several surveys of various parts of the Shatt-al-Arab were completed by the survey officers of the Royal Indian Marine.

In 1921-22 the R.I.M.S. *Palinurus* was again employed in the Persian Gulf, but mostly in small investigations: no definite surveys were completed.

GEOLOGY

The paucity of the bibliography appended to Dr. Pilgrim's Memoir of 1905 (quoted below) is a measure of the interest taken in the application to the Persian Gulf of this branch of science until the beginning of the present century.

From 1855, when Loftus[1] first published his valuable paper, little, if anything, of value on this subject was published, except by De Morgan, till 1904, when Lord Curzon sent Dr. G. E. Pilgrim of the Indian Geological Department to the Gulf. He made a general geological reconnaissance of both coasts, combined with a closer examination of localities, where the existence of minerals was suspected; some coal seams in the country behind Sur in Oman had previously been scientifically examined by Doctors von Krafft and Oldham of the same department.

Since the appearance of Dr. Pilgrim's report, no further geological research in this region has been undertaken by the Government of India or by His Majesty's Government. Between 1901 and the present day, however, an immense amount of work has been done by the geologists of the Anglo-Persian Oil Company, Limited, some of the results of which are embodied in Mr. Richardson's paper of 1924. A careful enquiry, with negative results, was also made in 1920 by an expert on behalf of the Persian Mining Syndicate, Limited, regarding the copper-mines of Kerman. But the geology of the Arabian side of the Persian Gulf and the Gulf of Oman is little, if at all, better known than fifty years ago, and the hinterland is still virtually a sealed book.

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[1] W. K. Loftus, appointed to succeed Mr. Angus as Naturalist and Geologist, left England to join the Turco-Persian Frontier Commission under Lt.-Col. Williams in January, 1849, on a salary of £200 a year. (Return to House of Commons, April 10, 1851.)

[2] With acknowledgments to Mr. N. Campbell Smith, M.C., Brit. Mus. Nat. Hist.

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Some Notes on the Geology of the Persian Oil Fields. H. G. Busk and H. T. Mayo, *Jour. Inst. Petrol, Technol.*, 1918.

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The Heart of Arabia, 2 vols. (Appendix). H. St. J. Philby, 1922.

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Cambridge Ancient History, vol. i. Egypt and Babylonia, 1924.

The Delta of the Shatt-al-Arab and Proposals for dredging the Bar. A. T. Wilson. *G. J., Feb.* 1925.

In Unknown Arabia, Maj. R. E. Cheesman, O.B.E., 1926.

MEDICAL .

There is a very notable lack of published information on medical subjects relating to this region. The only recent technical articles on the subject are by Dr. Sir W. Willcox, K.C.I.E., C.B., C.M.G., in the 12th edition of the *Encyclopœdia Britannica* under the heading "Persian Gulf," and three most valuable articles by Dr. Neligan, Physician to the British Legation at Tehran, in the *Lancet* for March 20, March 27, and April 3, 1926; who has also written a compendium under the title *Hints for Residents and Travellers in Persia* (1914). Epidemics and Sanitary Organisation in this region have, however, received a great deal of attention. The general history of plague and cholera is given in the appropriate articles of the *Encyclopœdia Britannica;* notices of early epidemics of plague will be found in an official précis *The First Connection of the Hon. E. I. Coy, with Turkish Arabia*, Calcutta, 1874; and an article, "Notes on Cholera in Persia," by Surgeon-Major T. Ffrench Mullen in the Persian Gulf Administration Report for 1889-90 has a wider scope than its name suggests, and gives a general account of the movements of cholera, especially in Western Asia, since 1821. The outbreak of cholera in Oman, in 1899, is discussed in Lt.-Col. A. S. G. Jayakar's "Report on the Recent Epidemic of Cholera in Maskat and Matrah"—in the Persian Gulf Administration Report for 1899-1900.

The general practice of medicine by European doctors in Persia is discussed by Mrs. Bishop in *Journeys in Persia and Kurdistan*, 1891; by E. Treacher Collins in *In the Kingdom of the Shah*, 1896; and by Dr. C. J. Wills in *In the Land of the Lion and the Sun*, 1883; and numerous further references thereto are to be found in current literature, particularly in Mrs. C. Colliver Rice's *Persian Women and their Ways*, 1923. See also: *A Chapter from the History of Cannabis Indica*, by E. G. Browne in *St. Bart's Hosp. Jour.*, 1897, March and "The Opium Trade through Persian Spectacles," by A. T. Wilson, *As. Rev.*, 1925, April. vol. xxi.

The subject of medical missions is treated by the Rev. S. M. Zwemer in *Arabia: The Cradle of Islam*, and by P. W. Harrison in *The Arab at Home*, 1924.

METEOROLOGY

The literature on this subject is very extensive: early travellers of every nationality vied with each other in picturesque denunciations of the climate of the Persian Gulf, and more particularly of Muscat, Bandar Abbas, Hormuz and Bushire, Arab and Persian writers being no whit less intemperate than Europeans in their allusions to the subject. Prevailing winds were carefully studied and accurately described, and the potentialities of various ports as sources of fresh water were better known in the sixteenth and seventeenth centuries than they are to-day. Generations of British Consular and Telegraph Officials have derived a dismal satisfaction from their self-imposed task of taking daily thermometer readings and submitting periodical reports on the subject to a "higher authority" more fortunately situated in Whitehall or on a Himalayan hill-top, and these melancholy statistics have been regularly tabulated and embodied in annual reports, books of travel and the like, and occur with monotonous regularity in the form of appendices to every official report dealing with the area. But these dry bones tell us little: the wet-bulb temperature alone affords any real indication of the probable degree of discomfort that will be experienced by a European at any particular place and time, and such records have not, as a rule, been kept so carefully nor, where available, are they so reliable, as the dry-bulb figures.

Apart from local statistical information, the chief recent sources of information are as follows:—

(1) The Persian Gulf Pilot.
(2) The Annual Summaries of the Meteorological Department of the Government of India.
(3) An article, "Climatology of Southern and Western Asia," by W. L. Dallas, of the Meteorological Department of the Government of India, in the proceedings of the Chicago Congress of August, 1893, Meteorological Section, pp. 672-686. A lecture on "Weather and Warfare" delivered by the same authority before the United Service Instit. of India (*vide* Journal for Oct., 1904).
(4) "The Weather of Iraq"—a comprehensive non-technical memorandum by Mr. Norman of the same Department, whilst on active service in Mesopotamia.
(5) "Notes on Climate and other subjects in Eastern Mediterranean and adjacent countries. I. D. 1117. Prepared on behalf of the Admiralty and War Office." (Including statistics of Mesopotamia and the Persian Gulf.)

Mention must also be made of two valuable papers published in German by Dr. Gerhard Schott:

(1) On the salinity of the Persian Gulf and its adjoining waters. *Annalen der Hydrographie,* 1908.
(2) The geography of the Persian Gulf and its neighbourhood. *Mitteilungen der Geographische, Gesellschaft,* Hamburg, 1918.

It is sad to reflect that, with all this wealth of information at their disposal, in addition to a vast mass of official literature on the subject, accumulated by military and civil officials during the last hundred years, the military authorities in India, on the outbreak of the World War, declared themselves (no doubt with perfect truth) to be entirely ignorant of the climatic conditions at the head of the Gulf, and proceeded to display an ineptitude in the provision of clothing, medical and hospital equipment, and food which, though it brought disgrace and dismissal to no individual, involved tens of thousands in untold miseries, brought death to thousands, and did more than is even yet realized to damage the good name of the Government of India at home and abroad. British officials are in no way inferior to Germans in the systematic collection and transmission of information; our national weakness lies, in the writer's judgment, in the reluctance shown at headquarters—whether in Whitehall, or Simla, or elsewhere—to retain the small additional staff necessary to collate and compile the information that reaches the central administrations, and to the general tendency to trust to hasty improvisations and to ignore or belittle the value of expert testimony and scientific investigation.

MUSIC

Floyer, in his *Unexplored Baluchistan,* 1882, Appendix E, and Rivadeneyra, in his *Viaje al interior de Persia,* Madrid, 1880, vol. ii, p. 265, make some brief references to Baluch and Lur harmonies respectively, and give some musical scores; there are also several reproductions in European notation of Persian harmonies in *Popular Poetry of Persia,* translated by Alexander Chodzko, 1842. References to Persian music and musical instruments, of much interest, are also to be found in many works, notably those of Chardin, Le Brun, Niebuhr, Ouseley, Jourdain and Waring. Probably the only detailed work on the subject of European music in the Persian language is the *Dastur-ul-Tar,* a treatise on the banjo and guitar, by Col. Ali Naqi Khan Waziri.

PHILOLOGY

The dialects of Arabic and Persian spoken on the Persian Gulf littoral differ considerably from the parent tongues, as spoken to-day on the plateaux of Arabia and Persia respectively. Each dialect, as is to be expected, owes much to the other: both have incorporated certain words of foreign origin which reflect the history of the Gulf and its use as a highway from earliest times; but excluding these words, none of which, except a few words borrowed from the language of the western littoral of India, are peculiar to the Gulf, there remains, it appears, a residuum of words, mainly relating to ships, and to the practice of navigation, which are neither Arabic nor Avestic in origin and which are common to both sides of the Gulf. It is not beyond the bounds of possibility that these words may prove to be of "Sumerian" origin: in any case, expert inquiry into this department of science might be of assistance to archæologists and anthropologists alike. In 1889, Surgeon-Major A. S. G. Jayakar published some notes on the Omani dialect of Arabic, in the Journal of the Royal Asiatic Society. Lt.-Col. D. L. R. Lorimer gave us in 1922 (Royal Asiatic Society's Prize Publication) a scholarly survey of the Kermani dialect and Bakhtiari dialects: Major Phillott has published an amusing series of proverbs current at Kirman; and Lt.-Col. and Mrs. Lorimer have laid the children of England under an abiding obligation by the publication, in 1919, of a charming volume of *Persian Tales,* still current among the common people in South Persia. The works of the late Prof. E. G. Browne are not less indispensable to those who live in South Persia than to those who live in the North. The Rev. J. Van Ess wrote, for the use of the Army in Mesopotamia during the war, a careful summary of the *Spoken Arabic of Mesopotamia,* supplemented two years later by a more ambitious, but not less useful work on *Written Arabic.* Finally, reference must be made to the monograph on the Baluch language, spoken along the Makran Coast, which is included in vol. x of the Linguistic Survey of India by Sir G. A. Grierson.

TERRESTRIAL MAGNETISM

In this field of research, it has fallen to the United States to lead the way. One of the main objects, to which the energies of the Department of Research in Terrestrial Magnetism, of the Carnegie Institution of Washington, have been devoted since 1904, has been a general magnetic survey of the globe. This survey has now been completed for the major part of the earth, and the results are being published in a series of voluminous reports under the title "Land" and "Ocean Magnetic Observations," covering the period from 1905 to 1921. Four volumes had (1924) already been issued and a fifth and final volume to be entitled "Ocean and Magnetic Observations, 1915-1921, and Special Reports," is in course of preparation. With the completion of vol. v it will be possible to undertake the reduction of the accumulated magnetic data since 1905, to a common datum for the construction of new world magnetic charts, and to make a new analysis of the earth's magnetic field on a basis of more complete and more accurate data than heretofore available.

The researches of the Department were confined, in the main, to the oceans and to those countries or regions where magnetic data would not otherwise be obtainable; and in some regions the magnetic surveys were accomplished in co-operation with existing organisations or with interested investigators. In Asia, the observers who were assigned to this continent obtained magnetic data in every state, excepting Afghanistan, the Himalaya States, and Chosen. The Persian Gulf region itself—including the territories of Persia, Iraq and Arabia—which formed but a small section of the field of operations in Asia—was fortunate in falling under the detailed scrutiny of the observers. Observation stations were established, between the years 1905 and 1910, at a great number of places, well distributed over the whole area. On the Persian side of the Gulf, observations were made at Tehran, Hamadan, Kermanshah, Shustar, Ahwaz, Mohammerah, Shiraz, Bushire, Lingeh, Jask, besides some thirty or more other places; in the Euphrates-Tigris area, at Mosul, Baghdad, and Basra among other places; and in Arabia at Kuwait, Bahrain Island, Aden and Ma'an. Volume i of the report includes a valuable description of each of the stations, and the conditions under which the magnetic observations were made, indicating, in most cases, the precise spot at which operations took place, thus making matters comparatively easy for further investigations at these places. Volume iv gives detailed information of much value regarding the methods used by the observers. The volumes isued are under the following titles[1] :—

Researches of the Department of Terrestrial Magnetism, of the Carnegie Institution of Washington :—
Vol. i. Land Magnetic Observations, 1905-1910.
Vol. ii. Land Magnetic Observations, 1911-1913, and Report on Special Researches.
Vol. iii. Ocean Magnetic Observations, 1905-1916, and Report on Special Researches.
Vol. iv. Land Magnetic Observations, 1914-1920.
Vol. v. Ocean Magnetic Observations, 1915-1921 and Special Reports.

ZOOLOGY

(*a*) *Mammals, Birds, Reptiles, Insects.*—

Ainsworth, who accompanied the Chesney Expedition,[2] already referred to, furnished Col. Chesney with reports on the natural history of the region traversed, including mammals, birds, reptiles, and fishes, which were in due course published.

Mr. W. T. Blanford, who accompanied Sir F. Goldsmid's Mission in South-East Persia, contributed to the latter's memoirs, in 1876, a supplementary volume in which his own extensive researches into the fauna of South-East Persia were collated with all material then available regarding the fauna of Persia generally. In 1905, and again in 1911, two British naturalists, the late Col. Bailward and Mr. Woosnam, travelled in Arabistan and made extensive collections of birds and small mammals. Sir P. Z. Cox, in the course of a long and distinguished career in the Persian Gulf, extending over nearly thirty years, found time to devote some attention to zoology which, after philately, was his favourite hobby : the pages of the *Bombay Natural History Society's Journal,* and the collections in the South Kensington Museum, bear witness to the keen scientific interest he took in the subject. It was largely owing to his foresight that the Bombay Natural History Society published,[3] after the war, a collection of monographs of exceptional value on the fauna of Iraq, its butterflies, moths, beetles, and innumerable insect pests. These memoirs, whilst dealing primarily with Iraq, apply in large measure to the Persian Gulf region, which is inhabited or visited largely by the same species as Iraq. To his initiative, the London Zoological Gardens owe a fine specimen of Oryx,[4] presented to H.M. The King, by Ibn Saud, and a pair of ostriches from Central Arabia, the first specimens of this rare struthious bird to reach Europe alive.

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[1] All volumes quoted are to be seen at the following libraries in London :—
British Library of Political Science.
Library of the Royal Society.
Library of the Science Museum.
University College Library.
University of London Library.
Institute of Petroleum Technologists.

[2] Chesney, *Expedition to the Euphrates and Tigris,* vol. ii. Appendices, ii-vi, 1850.

[3] *A Survey of the Fauna of Iraq,* Dulau & Co., 1922.

[4] It is generally supposed that unicorns, which Varthema saw at Mecca in 1503 and which he described in great detail, were anomalous specimens of the Oryx : on the other hand, the figure of the unicorn, as depicted in several places at Persepolis, is referred to by Pliny (*Hist. Nat.* viii, 21) and in the Bible ; whilst in more recent times, Don Juan Gabriel, a Portuguese colonel, who lived several years in Abyssinia, claimed that he had actually seen it, and his account was confirmed by a Portuguese missionary who was then living in Abyssinia ; it is also reported from the Cape of Good Hope in 1792 (see Varthema's *Travels,* Hakluyt Soc., 1863, and Renaudot's *Ancient Accounts of India and China,* 1733, pp. xxv, 17 and 61).

To him also we are indebted for the recent important accessions to our knowledge of the birds and mammals of the Persian Gulf and Central Arabia, collected on his behalf during 1922-24, by his Secretary, Capt. R. E. Cheesman, now H. M.'s Consul at Addis Ababa. As a result of these researches, our knowledge of the zoology of the Gulf region is more complete and accurate than in any other branch of science.

The upshot of these investigations is to show that South Persia and the Persian Gulf region are inhabited by animals which show, in every group, far closer affinity to European than to Indian forms : the Perso-Baluch frontier or the Sind desert east of it thus constitutes a line of demarcation which is both ethnological and zoological.

Additional Bibliography :[1]

Mammals.—

Nature at the Desert's Edge, by Major R. W. G. Hingston, 1925.

A new race of Hare from the Persian Frontier of Mesopotamia. *Records of Ind. Mus.,* vol. xv, p. 49.

On some Specimens of Mammals from Oman, South-East Arabia, by O. Thomas. Collected by Dr. Jayakar. *P. Z. S.,* 1894, p. 448.

Five new Mammals from Arabia and Persia,[2] by O. Thomas, *Annals and Mag. Nat. Hist.,* Ser. 7, vol. x, Dec. 1902.

On a collection of Mammals from Persia and Armenia presented to the Brit. Museum, by Col. A. C. Bailward. O. Thomas, *P. Z. S.,* 1905, vol. ii, No. xxxv, p. 519.

On Mammals from Northern Persia, presented to the National Museum, by Col. A. C. Bailward. O. Thomas, *Ann. and Mag. of Nat. Hist.,* Ser. 7, vol. xx, Sept. 1907.

Birds.—

A list of papers on birds in this region follows Ticehurst's Birds of Mesopotamia, in *Survey of Iraq Fauna.* The following are additional papers :—

Notes on the Bird Life of Ahwaz, Persia. F. Ludlow. *J.B.N.H.S.,* vol. xxv, p. 303.

On a collection of Birds from the vicinity of Muscat. (Made by Col. Miles). R. B. Sharpe. *Ibid.,* 1886, p. 162.

J. S. Whittaker on two species of Passerine Birds (Cummig's Chat). *Ibid.,* 1902, p. 58.

Un viaggio in Persia, nel. 1862. F. de Filippi, Milano.

Astola. "A summer cruise in the Gulf of Oman." Butler, *Stray Feathers,* 1877, p. 283.

Birds of Jabrin, Jafura and Hasa, and of Bahrain Islands, Persian Gulf. Ticehurst and Cheesman. *J. B.N.H.S.,* Jan., 1925.

Birds of the Persian Gulf Islands. Ticehurst and Cox, *J. B. N. H. S.,* vol. xxx, p. 725.

Birds of Iraq. Ticehurst and Cox, supplementary papers. *J. B. N. H. S.,* vol. xxxi, p. 91.

Reptiles.—

Description of a new sand boa from the Persian Gulf (Kuwait). *Records of the Indian Museum,* ix, p. 217.

Insects.—

Description of two new species of Deptera from Seistan, East Persia. *Records of the Indian Museum,* xvi, p. 299.

(*b*) *Fish and Fisheries.*—

The best recent general authority on this subject is S. B. Miles, in *The Countries and Tribes of the Persian Gulf,* 2 vols., 1919. Other sources of information are articles in the *Bombay Natural History Society's Journal* as follows :—

Vol. xiv, 1901. On Some Deep Sea Fishes collected by Mr. F. W. Townsend in the Sea of Oman. G. A. Boulenger. (In the same volume is an interesting note regarding Sword Fishes striking a ship (Muscat).)

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[1] With acknowledgements to Capt. R. E. Cheesman.

[2] This includes the Arabian fox and Witherby's field mouse.

Vol. xxiv (4) and xxv (1); 1916-7. The Game Fishes of the Persian Gulf. Major W. H. Lane.

For detailed zoological information regarding marine fishes, consult *A Bibliography of Fishes,* by Bashford Dean, published by the American Museum of Natural History; and, in particular, works by Annandale, Boulenger, Day (The Fishes of Zanzibar, 1866 with illustrations) and Regan.

The war gave birth to a crop of fisherman's stories of great carp in Mesopotamia, which saw the light in the *Bombay Nat. Hist. Soc. Jour.,* vols. xxv, xxvi, xxvii (1918-20).

For details of sea-snakes in the Persian Gulf, see *Bombay Nat. Hist. Soc. Jour.,* vol. xxx, 1924, p. 174.

On the general question of Persian Gulf fisheries, the most authoritative source is still Dr. McIvor's report published in the Persian Gulf Political Residency Administration Report for 1880-1, entitled "Notes on Sea Fishing in the Persian Gulf."

Further information regarding the fresh water fish of Iraq is contained in Cuinet's *La Turquie d'Asie,* 1894, vol. ii.

Other papers are :—

An enemy of certain Pearl Oysters in the Persian Gulf. Annandale. *Records of the Indian Museum,* vol. i, p. 176. (This gives the names of three varieties of Persian Gulf Pearl Oyster).

Notes on Fish from India and Persia, with descriptions of new species. J. T. Jenkins.

On a collection of Fishes made by W. T. Blanford in 1872, in Persia and Baluchistan. *Records of the Indian Museum,* vol. v, p. 123.

Report on the Aquatic Fauna of the Seistan with subsidiary studies. (Fish—mollusca—birds, etc.) *Records of the Indian Museum,* vol. xviii.

Remarks on the Oyster Beds in the Persian Gulf. Lewis Pelly. *Trans. Bomb. Br. Roy. As. Soc.* 1868, xviii.

An account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia, G. A. Boulenger. *Proc. Zool. Soc.,* 1887, pp. 653-67.

Second account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia. G. A. Boulenger. *Proc. Zool. Soc.,* 1889, pt. 2, pp. 236-46.

Third account of the fishes obtained by Surgeon Major A. S. G. Jayakar at Muscat, east coast of Arabia. G. A. Boulenger. *Proc. Zool. Soc.,* 1892, pp. 134-36.

Six semaines de dragages sur les bancs perliers du Golfe Persique. Ch. C. Pérez. *Bull. professionnel et technique des pêches maritimes.*

Perlen und Fischhandel des Persischen Golfes. R. Brenner. *Peterm. Mitteil.,* 1873, pp. 60-62.

Perlfischerei im Persische Meerbusen. Anon. Vossische Zeitung, 1881, no. 37.

(*c*) *Mollusca.*—

Of the numerous monographs, referred to below, on the Mollusca of the Persian Gulf, the greater number were based on specimens obtained by Mr. F. W. Townsend, who for many years commanded the Indo-European Telegraph Department's cable ship "Patrick Stewart." The complete list[1] is as follows :—

New Species from the Persian Gulf. E. A. Smith. *Ann. and Mag. Nat. Hist.,* May 1872, pp. 351-355.

Description of 34 species of Marine Mollusca from the Arabian Sea, Persian Gulf and Gulf of Oman. J. C. Melvill. *Mem. and Proc., Manchester, Lit. and Phil. Soc.,* vol. 41, pt. 3, pp. 1-25 and 2 plates.

Further Investigations into the Mollusca Fauna of the Arabian Sea, Persian Gulf and Gulf of Oman with descriptions of 40 species. *Op. cit.,* vol. 42, pt. 2, pp. 1-40, and 2 plates.

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[1] For this the writer is indebted to Mr. J. R. le B. Tomlin, M.A., of the British Museum (Natural History Section).

Notes on the Mollusca of the Arabian Sea, Persian Gulf and Gulf of Oman, mostly dredged by Mr. F. W. Townsend, with descriptions of 27 species. *Ann. and Mag. N. H.* (7) iv, pp. 81-101, with 2 plates.

Description of Conns (Cylinder) Clytospira 2 p.n. from the Arabian Sea. *Ann. and Mag. N. H.* (7) iv. 461-3.

The Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced mainly through the collections of Mr. F. W. Townsend, 1893-1900, with description of new species. By J. C. Melvill and R. Standen. *Pr. Zool. Soc.,* 1901, pp. 327-460, with 4 plates.

The genus Scala as represented in the Persian Gulf, Gulf of Oman and North Arabian Sea with description of new species. By Melvill and Standen. *Journ. of Conch.,* vol. x, pp. 340-51, and one plate.

A Revision of the Columbellidae of the Persian Gulf and North Arabian Sea with description of *C. calliope* n. 2 p. Melvill. *Journ. of Malacology,* x, 27-31.

Descriptions of 68 new Gastropoda from the Persian Gulf, Gulf of Oman and North Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1901-3. *Ann. and Mag. N. H.* (7) xii, 299-324, with 4 plates.

Descriptions of 23 species of Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1903. By Melvill. *Proc. Malac. Soc.,* vi, 51-60, with plate.

On Berthais, a proposed new Genus of Marine Gastropoda from the Gulf of Oman. By Melvill. *Proc. Malac. Soc.,* vi, pp. 61-3.

Descriptions of 28 species of Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea, dredged by Mr. F. W. Townsend of the Indo-European Telegr. Service, 1900-4. By Melvill. *Proc. Malac. Soc.,* vi, 158-69, with plate.

Conus coromandelicus, Smith, its probable affinities and systematic position in the Family Conidae. By Melvill. *Proc. Malac. Soc.,* vi, 170-73.

Descriptions of 12 new species and one of Marine Gastropoda from the Persian Gulf, Gulf of Oman and Arabian Sea collected by Mr. F. W. Townsend, 1902-4. *Journ. of Malac.,* xi, 79-84, with plate.

Note on *Mitra Stephanucha, Mch.,* with description of a proposed new variety. By Melvill. *Journ. Malac.* xi, 86.

Rostellaria delicatula, Nevill, notes on its distribution and limits of Variation. By Melvill and Standen. *Journ. of Conch.,* vol. xi, 161-3, with plate.

Descriptions of 31 Gastropoda and one Senphopod from the Persian Gulf and Gulf of Oman, dredged by Mr. F. W. Townsend, 1902-4. Melvill. *Proc. Malac. Soc.,* vii, pp. 69-80, with 2 plates.

Capulus lissus, Smith as type of a proposed new sub-genus. By Melvill. *Proc. Malac. Soc.,* vii, 81-4.

The Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced mainly through the collections of Mr. F. W. Townsend, 1893-1906, with descriptions of new species. Melvill and Standen. *Proc. Zool. Soc.,* 1907, 783-848, with 4 plates.

Descriptions of 29 species of Marine Mollusca from the Persian Gulf, Gulf of Oman and North Arabian Sea, mostly collected by Mr. F. W. Townsend, of the Indo-Europen Telegr. Service. Melvill. *Ann. and Mag. Nat. Hist.* (8), vi, pp. 1-17 and 2 plates.

A Revision of the Species of Pyramidellidae occurring in the Persian Gulf, Gulf of Oman and North Arabian Sea, with description of new species. Melvill. *Proc. Malac. Soc.,* ix, 171-207, with 3 plates.

Descriptions of 33 new species of Gastropoda from the Persian Gulf, Gulf of Oman, and North Arabian Sea. Melvill. *Proc. Malac. Soc.,* x., 240-54, with 2 plates.

Revision of the Species of Terebra occurring in the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced in the Collection formed by Mr. F. W. Townsend, 1893-1914. Melvill and Standen. *Journ. of Conch.,* xv, 204-16.

Revision of the Turridae occurring in the Persian Gulf, Gulf of Oman and North Arabian Sea, as evidenced mostly through the results of dredgings carried out by Mr. F. W. Townsend, 1893-1914. By Melvill. *Proc. Malac. Soc.,* xii, 140-201, with 3 plates.

Descriptions of 34 species of Marine Mollusca from the Persian Gulf, Gulf of Oman and Arabian Sea, collected by Mr. F. W. Townsend. *Ann. and Mag. N. H.* (9), i, pp. 137-58, with 2 plates.

Freshwater shells from Mesopotamia. *Records of the Indian Museum.* vol. xv, p. 159.

Mention should also be made of an article by J. C. Melvill and R. Standen on the Mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea in the *Proceedings of the Zoological Society* for 1901, vol. ii, and a further article on the same subject by Melvill, in vol. xlii of the *Transactions of the Manchester Literary and Philosophical Society,* 1897.

General.—

In Unknown Arabia, Maj. R. E. Cheesman, O.B.E., 1926.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY)

BY

T. R. BELL, C.I.E., I.F.S. (Retd.)

PART XXXVII

(*Continued from page 351 of this Volume*)

Genus 28.—BARACUS.

Imago.—This is very like or similar to *Taractrocera nicévillei,* only larger, on the upperside; below it is different. See description below.

Antennæ.—With the club moderate, gradual, rather long, acuminate and somewhat suddenly bent, though curved, about half the length of the costa of forewing.

Palpi.—Porrect, conspicuous as to third joint; second joint somewhat laxly scaled.

Hind tibiæ.—Fringed and with two pairs of spurs.

Forewing.—Vein 12 ends on costa before end of cell; 11 curves upwards and runs close to 12 but does not touch it; cell less than two-thirds the costa; middle discocellular longer than lower; vein 5 emitted below the middle of discocellulars; 3 from close to lower end of cell, 2 from about one-third before end; wings somewhat short, triangular; costa gently arched; apex subacute; outer margin convex, hinder angle rounded; hinder margin longer than outer.

Hindwing.—Vein 7 emitted close to upper end of cell; 5 almost obsolete; discocellulars faint; vein 3 close to lower end of cell; 2 from less than one-third from end; wing evenly rounded.

Egg, larva, pupa, habits.—See below as they are only known for a single species, *Baracus hampsoni.*

The genus *Baracus* consists of four species in British India, one in Luzon, Philippine Islands and one in Tibet and W. China. The Indian ones are *septentrionum,* W.—M. and de N.; *hampsoni,* El. and Edw.; *subditus,* M. and *vittatus* (Felder). These are found respectively in Assam, Sikkim and Burma; in Kanara, S. India; in S. India and Ceylon; and in Ceylon. It is really very doubtful whether *subditus* and *hampsoni* are distinct species by the marking and Swinhoe's descriptions contained in *Lepidoptera Indica,* vol. x, pp. 131-133. Also it may perhaps be worth mentioning that both de Nicéville and E. Y. Watson identified the Kanara species long ago as *Baracus septentrionum.* Swinhoe figures all four species on Plates 787 and 788; *hampsoni,* is figure 3 male, figure *3a* female and *3b* underside; *3c* is the larva and pupa.

221. **Baracus hampsoni**, El and Edw.—Male. *Upperside* dark olive-brown. Forewing with two pairs of linear, ochreous spots in a line on the disc, two subapical below costa, the other two discal in interspaces 2 and 3. Hindwing immaculate. *Underside.* Forewing blackish-brown, the costal space ochreous in a broad band from base above cell to termen bounded below at apex by vein 6, continued decreasingly down a long termen to middle, interspaces sometimes marked with brown, the veins at others; the subapical spots as on upperside, the discal often wanting—they are always the smaller; and a series of obscure, yellow, subterminal spots in interspaces 3 to 7 on the dark-ochreous suffusion. Hindwing: the ground colour deep-ochreous, including veins, leaving brown,

terminal spots in interspaces 1*b* to 6, those in 2 and 6 largest, that in interspace 5 the smallest; interspace 1*a* brown, sprinkled sparsely yellow, the lower half of 1*b* completely yellow, the upper half with one brown spot under the middle of vein 2 and a series continued straight across interspaces 2, 3, then obliquely outwards across 4, 5 to the terminal spot in 6; besides a brown spot at termen in interspace 7 and another before its middle. *Cilia* dark-brown at base, the outer part lighter brown on forewing, ochreous on hindwing, somewhat soiled at ends of veins.—Female similar to the male (Swinhoe says). Antennæ black above, the bend not abruptly at a right angle, below ochreous with the joint narrowly black; the club black above and below with the tip brown-red; palpi brown above, whitish beneath and the third joint yellow beneath, porrect, somewhat prominent; second joint moderately densely scaled. Head is brown with some ochreous scales; thorax more or less concolorous with wings; abdomen absolutely concolorous with wings; below very pale ochreous, the legs with a strong rusty tinge.

From a large series bred in Kanara the female differs from the male in having an extra small, quadrate spot just touching vein 1, not reaching half-way across the interspace 1 situated under the middle of vein 2 as to position and often joined by a line of yellow scales to the inner, lower corner of the spot in 2; there is, also, often an extra subapical dot in interspace 8 and even a few yellow scales in 5 below the outer, lower corner of the spot in 6. The underside of the female is also duller-ochreous on both wings, more brown-washed. The male has a broad ochreous scale-sprinkled area above vein 12 on the upperside of forewing reaching half way to termen, some few ochreous decumbent hairs at base of inner margin and absolutely no hair-fringe along that margin. On the upperside of hindwing there is a sparse covering of longish, brown hairs below the cell from it to anal margin. The female has the costa very slightly tinged with ferruginous in the same place; and the third joint of palpus is slightly more prominent than in the male. Expanse 27 mm. in the female, slightly less in male.

Egg.—It is more or less hemispherical in *shape* but the cylindrical sides are somewhat prolonged for a true hemisphere. The *surface* is shining and very finely tuberculate all over with minute, isolated tubercles; there are 17 thin, slightly raised meridional ridges starting from the absolute base and losing themselves towards the top of the egg, the space on the top where there are none being 0.5 mm. in diameter: all this space is minutely cellular and at the very apex is the depressed, somewhat irregularly-circular micropyle surface which itself is extremely minutely cellular-reticulated; the surrounding larger cells are 0.5 mm. in diameter; the micropyle-surface is 0.15 mm. in diameter; the space between the ridges at base of egg is 0.15 mm. and at top where they lose themselves it is 0.10 mm.; the breadth of a ridge is just one-third of 0.05 mm. and the height is about the same. The *colour* of the egg is a pearly white blotched irregularly and largely with blood-red. The ridges are minutely and irregularly beaded. B : 0.85 mm. H : 0.65 mm.

This egg, or rather four eggs of this type were sent from Karwar to-day, July 26, 1918; they were laid on grass or rice, on the upper surface, always close to the edge or towards the point.

Larva.—At 9.45 on the morning of July 31, the four larvæ emerged from the egg: little honey-yellow, cylindrical things with enormous, nearly black, shining, smooth heads and a black, rather broad collar on segment 2 which occupies the middle of the segment nearly from spiracle to spiracle and is about half as broad as the segment is long; the body is provided with the usual erect hairs, short and fine with no sign of dark tubercles at their base. L : 2 mm. and breadth one-sixth of that; the head about 2x as broad as body. The larva emerges through the top of the egg, eating round with its jaws up to the commencement of the ribs: the opening thus made, all the substance of the 'lid' being thus consumed as food, is exactly the diameter of the head which first emerges through it: 0.50 mm. The egg-shell is nibbled a bit as food round the open edge but not always consumed—perhaps never. Then the larva immediately wanders off, spinning web-steps as it goes.

In the last stage but one the head is shining black, irregularly and strongly rugose-reticulate, nearly quite round (except for truncation of mouth-opening and slightly prominent mouth-parts) with no sign of sinus on vertex and a punctate-depressed, thin line to the apex of the triangular clypeus, the surface covered with minute, hardly visible semi-appressed grey down, which is, however, fine and does not obscure the shining black; some very slightly longer hairs about mouth-parts. The body is now glaucous green, the segment-margins marked thinly darker green and shining with four completely circling, parallel lines in front of each and a fifth parallel, partially encircling beyond—only the dorsal part of this last present; the whole covered with extremely minute, erect, fine white hairs except the anal segment which has them much longer and dark and each one (on this segment only) arising from a dark, small, conical tubercle, those round the margin still longer (again only the margin of the anal segment); the legs and prolegs all short and rather weak; the transverse section of body nearly circular except the anal segment which is flattened, long semi-circular in shape and conspicuous because of its clothing of tubercles and hairs; segment 2 white in its anterior half but with no black collar now; the glaucous green colouration of the whole body punctated with very numerous darker green dots except on ventrum and legs and anal segment; segment 13 about half the length of segment 12. *Spiracles* light yellowish; of segment 12 slightly larger, those of segment 2 much larger; all somewhat prominent; the spiracles are very small as a matter of fact and are all connected by a straight, thin, subspiracular, yellowish tracheal line showing through the skin. *Colour* glaucous-green with the dots and margins and parallel line mentioned above darker green; a dark, dorsal, thin band greenish-purplish, a subspiracular, thin tracheal line yellowish; the anal segment yellowish-white set with numerous brown, small tubercles; L: 19 mm.; B: 2.5 mm.

When full grown the *shape* is still rather long and slight, the front segments somewhat flanged along the dorsoventral margin. The *head* is very broadly oval with a very slight, triangular, narrow sinus on vertex, the surface rather strongly, irregularly cellular-rugose and covered with a clothing of very minute, accumbent, rather sparsely disposed, fine hairs; the clypeus is longly triangular, about half the height of the face; the false clypeus outside it much larger, triangular, nearly three-quarters the height of face; the labrum is very short but broader slightly than long; the ligula is rather large, with a large, deep, triangular sinus; both it and labrum red-brown, shining, like the surface of the face and head generally; the antennal joints the same colour, the second lighter than the basal one; the eyes are black, the first four in a curve, all close together, the two lower ones equal in size, larger than the two upper; colour of head generally brown-orange, lighter upwards, the clypeus, false clypeus and a narrow band down from vertex on each side of dorsal line somewhat lighter. *Surface* of larva is dull, smooth except for a covering of extremely minute, erect, light, fine hairs; that of the anal segment similar to the last stage; the segment margins well marked, the impressed, thin lines parallel to the hinder margins (immediately in front of them that is) also well marked; segment 13 about half the length of 12; segment 2 smooth and white; the legs and prolegs short and stout. *Spiracles* similar to last stage, very small, rather narrowly oval, prominent, light yellowish; those of segment 12 nearly twice the size, those of segment 2 much larger and broader oval. *Colour* olive-green, the segment-margins showing thinly darker and covered with darker green small spots all over the body, the whole except segments 2 and 14 with a rose flush or tinge except ventrally; segment 2 white, segment 14 whitish or lightish. L: about 25 mm.; B: 5 mm. at middle.

Under the lens there are some small, oval, glassy-looking, tubercle-like dots here and there on each segment which do not seem to coincide with the bases of the principal subdorsal, dorsolateral, spiracular hairs that larvæ generally possess—here these hairs are in no way longer or stronger than any others.

Pupa.—This is in no way out of the ordinary in *shape* except that it is somewhat slight; the *head* is square, rounded in front with a central, dorsal depression; the surface crinkled all over; the dorsal constriction at segment 5 slight; lateral outline parallel from the shoulders to end of wings, then the body gradually decreasing in diameter to the stout, square cremaster which is truncated at end with a short, sharp point at each corner that diverge slightly backwards; this cremaster with the perpendicular sides at base hollowed out and with strong, dorsal extensor ridges on each side with the dorsum between them concave from front margin to end; the whole of the hinder extremity of the cremaster is set with a dense fringe of longish, strong, hooked shafts between the two points. *Surface* smooth, shining and pitted all over on abdomen, rather coarsely wrinkled on head and segment 2. *Spiracles* of segment 2 indicated by a very conspicuous, large, dark-brown, ear-shaped, slightly-raised, somewhat funnel-shaped expansion on edge of thorax; the other spiracles are light-brown, longly-oval, each with a small, dark-brown line above and in front of it. *Colour* dirty brownish-soiled, subtranslucent white; end of cremaster dark-brown, the cremaster itself thin-translucent; a subdorsal, small, brown spot on each segment. L: 15.5 mm.; B: 3.125 mm.

Habits.—The larva makes a cylindrical cell by joining the edges of a blade of grass together at the point, either underneath or above and eats away the part of the leaf above the cell towards the stalk, leaving nothing but the midrib by which the cell hangs free; it clothes the inside with silk, thickened into steps along the sides and excretes a cereous, white powder at the end of the last stage when about to pupate. It makes cells as required to suit its increasing growth and, often, the old ones are found lying on the soil below. The pupal cell fits the chrysalis tightly and is closed at end by a little piece as a lid to prevent the ingress of enemies. This cell is, as often as not, cut loose and falls to the ground before the change takes place—it is then often more or less withered-looking and very inconspicuous amongst the lower dead blades of the grasses lying about. The pupa is attached inside by a string round the middle and by the tail; the body-string is jet-black. The butterflies frequent the hills of the Kanara District on the Western Ghats where the rainfall is anything from 150 in. to 400 in. It is very like *Taractrocera ceramas* in its habits, keeping close to the ground amongst the herbage, generally along the sides of paths and edges of clearings or openings in the jungle. It does not go into large openings like fields of paddy or extensive village sites. It flies somewhat weakly and never for long at a time; rests with its wings closed over the back either on the ground or on a grass-stem or leaf, etc., near the ground and is not fond of too much sun. In the monsoon months it is not an uncommon insect in Kanara above 1,000 ft. level but is rarely seen in the dry months. Its habitat is 'Kanara, S. India' according to Swinhoe and he remarks that it is 'A good and distinct species. The types in coll. Elwes came from North Kanara. We have both sexes from Karwar where Davidson, Bell and Aitken bred it. The larva and pupa now figured are from Davidson's original drawings; Hampson records it from the Nilgiris.' But, evidently Swinhoe does not believe the Nilgiri record. The larva feeds upon the soft grasses of the shady jungles.

Genus 29.—CUPITHA.

Imago.—Rather of the style of *Telicota* in the matter of pattern above; but a slenderer insect. Underneath the wings are pure sulphur-yellow except for the whole cell and outer area below vein 2 in a large triangular patch to tornus which is black on the forewing and the interspace 1*b* on the hindwing which is black in a long triangle with its base on the outer margin, coming to a point at base of wing.

Antennæ.—About half as long as the costa of forewing; club moderate with a pointed, abrupt crook rather longer than its breadth.

Palpi.—Second joint densely scaled; third joint minute, porrect.

Hind tibiæ.—Very slightly fringed with hair and with two pairs of spurs.

Forewing.—Vein 12 reaches costa before end of cell; cell about two-thirds length of costa; discocellulars nearly erect, upper minute, lower much shorter than middle, vein 5 strong from below the middle or junction of middle and lower; 3 emitted about one-eighth before end of cell, 2 from middle; costa arched at base, then nearly straight to apex; apex subacute; outer margin convex about equal to inner margin. In the male there is a short tuft of hair attached to the underside close to the origin of vein 1.

Hindwing.—Vein 7 a little before upper end of cell; discocellulars very faint, vein 5 absent; veins 2, 3, 4 equidistant from each other, close together; in the male there is a glandular patch convex on the underside at the origin of vein 2 distorting the lower margin of the cell and altering the relative positions of veins 2, 3; costa highly arched at the base, then nearly straight to apex which is rounded though well pronounced; outer margin evenly convex, hinder angle also pronounced.

Egg, Larva, pupa, habits.—See below as there is only a single species in the genus.

222. Cupitha purreea (M.).—Male. *Upperside* black-brown with gamboge-yellow markings. Forewing with the costal space above vein 12, reaching the middle of costal length and ending pointedly, leaving the costa very narrowly brown, gamboge-yellow; also a thin line from base running along the upperside of vein 1 to broaden at middle of interspace 1 into a trapeze-shaped spot filling the spaces up to vein 2, its inner edge slanting up to strike the vein well after its junction with cell, its outer edge straight; this spot being the basal portion of an outwardly oblique band ending narrow about the middle of vein 5, then turning up at right angles towards costa to fill interspace 5 as far up as 6 with a spot that is rather broader than the end of the band it arises from; the band consisting of one large, quadrate spot in interspace 2, its outer edge finishing somewhat further out than the lower trapeze-shaped one, followed by (the vein separating them even is yellow) a smaller spot filling the base of interspace 3 and reaching out a bit beyond the one below it, finishing with a somewhat oblique-edge spot in 4, the last one of the straight part of band; besides this there is a quadrate spot in the lower half of the end of cell joined on to the band by the yellow vein between the bases of veins 2 and 3 and separated from the outer end of band in interspace 4 by an interval of ground colour as large as itself; this yellow band-area has also a slightly less well-defined continuation below vein 1 to base of wing along the inner margin; there is a little long, decumbent, yellow hair covering under vein 1 towards base of wing; the hair-fringe along inner margin is very slight. Hindwing with a transverse band of nearly even width straight across the wing consisting of the basal half of interspace 2 all but the extreme base, continued across interspaces 3, 4, 5 and in the other direction into interspace 1*b*; the cell has a few decumbent, yellow hairs in it and there is a thick fringe of it in interspace 1*a;* the very base of wing is bare of scales and shining owing to the 'tympanum' of the sex-mark. The transverse, yellow band is very obscurely continued upwards from interspace 4 to costal border—but this is only indicated. *Underside*: pure gamboge-yellow. Forewing with the whole base of the wing black in the cell to nearly its end, extending downwards across the base of interspace 2, then obliquely inwards; the discocellular veins diffuse-brown (very faint sometimes) and a large black patch just before tornal angle in interspace 1, expanding upwards in a triangle to the middle of interspace 3. Hindwing with interspace 1*a* black except, sometimes, it is yellow to nearly half way out from base, the veins 1*a* and 1*b*, however, always edged black along the yellow. Antennæ are black above except the extreme tip of club which is brown-red; below, the shaft is yellow touched with black at the joints, the club black with the tip more longly red; the tip is short and bent back at less than a right angle. Palpi with the small, conical third joint black, the second black above but the hairs surrounding the third yellow; below gamboge-yellow. Thorax and head above yellow, below paler; the legs with tibia and tarsus orange-yellow as well as the coxa of the hind legs—this is nearly red. Abdomen black above and below, banded with yellow. The sex-mark is convex below, flattened-convex above, covered with scales below, bare and grey above and surrounded by a bare, shining space.—Female like the male, the gamboge-yellow band somewhat narrower. Expanse 27-30 mm.

Egg.—The egg is in *shape* a depressed hemisphere or limpet. The *surface* is divided into sections by, first, a large apical annulus from which 14 thin, absolutely regular, yellow meridions run to base; there are none inside the ring in the very centre of which is situated the micropyle; the ring is twice as broad and twice as high as the meridions, but all are composed of the same yellow, waxy-looking, pitted substance. *Colour* of egg is deep brown-red, the meridions and ring yellow. B: 1.3 mm.; H: 0.8 mm.

Larva.—The *shape* is somewhat like that of *Padraona dara;* the body held somewhat hunched in segments 3-5; the head drawn in, the mouth stretched forward; the anal end lying flat on the surface as also the ventrum. The *head* is more or less heart-shaped, the vertex-sinus very small and shallow, the face only moderately convex; the surface rough-reticulate, covered by an efflorescence of waxy little rough balls of white which look like scales to the eye; the true clypeus small, triangular, with the apex acute, about one-third the height of face, higher than broad; the false clypeus a broad, outwardly convex strip outside it, also triangular with the apex acute reaching more than half-way up face; the labrum a transverse curved (upwards) piece; the ligula small, kidney-shaped, both it and the labrum yellowish, shining; the ligula shortly haired along front margin; antennal basal joints both red-brown in colour; the mandibles red-brown, toothless; the eyes, four top ones in a strong curve, the two uppermost closer together than 3, 4; 6th in a straight line with 3, 4 but further removed from 4 than 4 is from 3, the fifth making an equilateral triangle with 5, 6 and behind them: all black; colour of head dark red-brown overlaid with white scales (see above); the hinder margin black; segment 2 occupied from spiracle to spiracle by a broad, chitinized, red-brown collar taking up most of the length of the segment, the whole segment much narrower than head. *Surface* of body covered with minute, short, white, erect broad-topped hairs about the same length as the spiracles except in the spiracular region including the margin of anal flap where they are longer but similar; segment-margins distinct; legs and prolegs short; anal flap trapeze-shaped, the hinder margin long, at least two-thirds the front margin, rounded as well as the extreme angles, the central portion of segment dorsally convex, sloping steeply to front margin leaving the lateral parts of the segment all round as a sort of flange; segment 13 over one-third length of 12 with the hinder margin very slightly slanting on each side backwards so that the segment is longest in the dorsal line; segment 14 equal in length to 12; all the segments lined transversely in the usual way with fine lines, all parallel to each other, 6 or 7 from hinder margin forwards on each segment. *Spiracles* small, very light-yellow, oval, those of segments 2, 12 double the size. *Colour* really green, the skin thin and the tracheæ visible beneath; but seemingly yellow from the fact that each little hair rises from a diffuse, small, more or less circular spot or blotch more opaque than the general skin; a dark-green, dorsal line turning to maroon from segment 11 to anal end, from segment 3 to end; the front and hinder margins of segment 13 also more or less maroon with a slight suffusion of that colour over the whole of that segment as well as on the extreme dorsal part of 14. L: 25 mm.; B: 4 mm.

Pupa.—Is of normal *shape;* fore-end square, blunt; hinder end pointed; fattest in middle; head and segment 2 forming a quadrate piece; thorax stout, clearly separated from segment 2, convex, a little broader than segment 2 and about the same breadth as abdomen at segment 8; the body gradually decreasing in diameter to anal end; cremaster not longer than broad, blunt-ended, decreasing in width backwards (to end), thin between the dorsal and ventral surfaces with two extensor-ridges dorsally, separated by the blunt end of cremaster and diverging slightly forwards; segment 13 about as long as cremaster, also as long as segment 12 which is only slightly shorter than 11; segments 4, 5 co-equal and less than segments 6, 7 in length; the hinder margin of thorax a quarter-circle curve meeting the wings in a very deep, broadly rounded angle of 90°; thorax as long as segments 4, 5, 6 together, only very slightly humped, the line joining the hinder and front margins (dorsal) at an angle of 30° to the longitudinal axis of pupa, the front margin quite straight; segment 2 about as long as segment 4 in the dorsal line, the front margin straight, the dorsal line inclined at an angle of 45° to longitudinal axis; the vertex of *head* fairly broad between the antennal bases, in the same plane as segment 2, with a sub-dorsal lowly convex, circular 'boss' near hinder margin, covered with rather long, erect, thick-topped hairs; the vertex in a plane at right angles to longitudinal axis with a central, more pronounced boss than that on the vertex, this boss flattened somewhat dorsally, also covered with hair of the same length as the other; proboscis reaching free to end of segment 10, the antennæ not reaching ends of wings. *Surface* shiny-corrugated irregularly under a strong lens, nearly smooth to the eye; clothed with erect, light, soft hairs with thickened tops which are about 0.17 mm. in length where they are shortest; there is a tuft of longer hairs—

as on the bosses on the head,—subdorsally on segment 2 also, these longer hairs all being about 0.5 mm. in length. *Spiracles* of segment 2 indicated by a large, oval, convex, raised, dull orange expansion which is 0.55 mm. × 0.25 mm.; the other spiracles are small and oblong, 0.175 mm. × 0.05 mm., light yellow, slightly raised. *Colour* is a light olive-green; often covered over with a cereous, white powder.

Habits.—The egg is laid in a cool part of the forest, often in a nalla-bed or near water; always single and on top of a leaf. The young larva makes a cell by turning over a small, oblong piece from the edge onto the top, making a cylinder out of it by joining the edge to the leaf-surface and it clothes the inside densely with silk; one end of the cylinder is closed by a small piece turned up from the free margin of leaf and held perpendicular by silks. Similar cells are made as required; later on of course larger; at the last moult the larva eats through the leaf on both sides of the midrib and perpendicularly to it from the edge and slightly into the substance of the midrib so that the part of the leaf beyond the cut hangs down; the edges of this hanging portion are then joined together, the portion withers and gets quite hard and shrivels—all but the well-coated inside tube along the midrib in which the larva lives; the opening is next the green portion of the leaf. Inside this cell it changes to the pupa. It only feeds at night and is very shy disliking the light; the elongate cell is often fastened to the underside of the leaf up against the green part to protect it the better from the sun and the rain. Not much is known about the habits of the imago as it is not a common insect and the flight is extremely rapid. It has been seen on the crest of the ghat in Kanara sitting on the top of a leaf once low down, but only for an instant; it has not often been caught on the wing; only once below the ghats at sea-level; the larvæ, however, are not uncommon above ghats in the semi-evergreen jungles at about 2,000 ft. on the leaves of *Combretum ovalifolium*, Roxb. *Terminalia belerica*, Roxb. and *Terminalia paniculata*, Roth., both of the family *Combretaceæ*; once, also, on *Ehretia lævis*, Roxb. (*Boraginaceæ*). The distribution is mentioned as Sikkim, Assam, S. India, Burma, Andamans, Java, Nias, Philippines.

Sub-family (8).—BAORINÆ.

This sub-family contains the genera *Baoris, Gegenes* and *Iton.* The last does not concern these papers. They are all butterflies that are most extraordinarily alike, mostly medium-sized, nearly all the same brown colour on the upperside with subapical dots and discal semihyaline-white spots on the forewing. The first genus is a very large one and it may be divided from *Gegenes* as under:—

A. Antennæ: with the terminal crook minute, never as long as
the width of club. . . . . *Gegenes.*
B. Antennæ: with the terminal crook short, as long as, or
slightly longer than the width of club . . . *Baoris.*

Gegenes only contains two species in British India and one in Hainan. The ones in India are called *nostradamas* from the N. W. Himalayas, extending to Central Asia, S. Europe and N. Africa; and *karsana* from Burma, Western India, Sind, Baluchistan, Afghanistan. *Baoris* contains twenty-five species not occurring in British India with twenty-nine that do—or a total of 54 species. To deal with these as a single genus evidently appeared somewhat difficult, for at various times they have been divided into sub-genera called *Baoris, Parnara* and *Chapra.* Swinhoe makes use of these and another, *Caltoris.* They can be distinguished as below :—

A. Antennæ : with the club short, stout.
  (*a*) Forewing : male with a linear, discal, white stigma . . . *Chapra,* M.
  (*b*) Forewing : male without such stigma . . . *Parnara, M.*
B. Antennæ : with the club comparatively elongate.
  (*a*) Hindwing : male with a tuft of long hairs on the upper side attached along the upper margin of cell and directed downwards across the cell . . . *Baoris,* M.
  (*b*) Hindwing : male without any such tuft . . . *Caltoris,* Swinh.

Imago.—Always of some shade of dark-brown above and below with the forewing nearly always marked with hyaline-white spots, three sub-apical, often two at the end of cell, and two or three on the disc or even more ; the hindwing very generally immaculate, at the most with (except in *Iton* where there is a large, white patch) some small semi-hyaline-white dots. The underside of forewing generally paler than on the upperside ; the hindwing often suffused grey or green or yellow and with some discal dot-spots.

Antennæ.—Short, about half the length of the costa of forewing or even shorter ; club moderate or short and stout with a short, sometimes very short, terminal costa.

Palpi.—Second joint densely scaled ; third very small, often concealed.

Hind tibiæ.—With two pairs of spurs.

Forewing.—Vein 12 reaches costa before end of cell ; cell less than two-thirds the length of costa ; upper discocellular minute, distinct, outwardly oblique (in *Iton* appearing like a straight continuation of end of cell), the lower much the shorter ; 5 consequently arising close to lower end of cell, curving gently up to get into position between 4 and 6 ; vein 3 from near lower end of cell, 2 from close to it ; costa slightly arched ; apex subacute ; outer margin convex, about as long as the hinder margin ; tornal angle blunt.

Hindwing.—Vein 7 from before end of cell ; discocellulars outwardly oblique, faint ; 5 absent ; 3 from close to end of cell ; 4 also close to 3.

Egg.—In *shape* it is a high dome standing on a very narrow, shelving base. *Surface* only slightly shining and quite smooth even under a high-power lens ; under the microscope there are indications of some, sometimes very many, meridional ribs on the basal band but they are extremely obscure. *Colour* from very light-green to very pale honey-yellow when first laid ; turning a kind of dull bone-colour later.

Larva.—Nearly always white, subcylindrical in *shape,* with a broadly-rounded anal end that lies flat on the surface ; flattest just before middle, the neck rarely as broad as half the breadth of body at middle ; the *head* always very much broader and higher than neck, more or less semielliptical in shape, either broad or narrower at apex, hardly bilobed, the surface somewhat shining, minutely cellular-rugose and covered with minute, appressed hairs that do not hide the sculpture or the colour. *Surface* of body dull, covered with extremely minute, fine, erect, light hairs all over, these rather longer round the free margin of anal segment ; segments well marked though never constricted in the least at margins, with superficial, impressed lines that are transverse and 5 or 6 in number, on the hinder half of every segment. *Spiracles* of segments 2, 12 much larger than others. *Colour* always a semi-translucent looking light grass-green all over with the cremaster a bit whiter and the wings the same after a few days ; always with a powdering of the cereous-white powder excreted just before the change to pupa.

Habits.—The eggs are always laid on the underside of a bamboo or grass leaf or blade ; the little larva eats the shell generally completely for a first meal ; then makes a cell by drawing together the edges of the leaf at tip over the undersides, often very laxly. When it is full grown it does the same by the whole leaf but even more laxly still, leaving it more or less quite open, just bent into a half-cylinder tube in which it lies, coating the bed with carpet of silk. It finally pupates in such a half-tube made with a couple of ropes of silk to keep the leaf bent, the inside carpeted, the pad for attachment of the cremaster not extremely thick with a simple rope across it to the middle of which the hooks of the cremaster are fixed ; the body of the pupa also has a string round it. The growth of the caterpiller is normal in the way of time; the pupal stage lasts about ten days but may be prolonged for some days. The butterflies are powerful fliers and some of them at least are characteristic of the Plains of India though even these are always to be found in the jungles and hills as well. Only *Gegenes* is purely an insect of the dry, arid places, the deserts chiefly.

Taking the divisions *Baoris, Caltoris, Parnara* and *Chapra,* the following are the respective insects that occur in British India including Burma, Ceylon, etc. :—

**Baoris farri* (M.), from Sikkim, Assam, Bengal, Kanara (Bombay), Ceylon and Burma and the Andamans.
Baoris unicolor (M.), from Sikkim and Assam.
**Caltoris kumara* (M.), from S. India, Ceylon.
**Caltoris seriata* (M.), from S. India, Ceylon.
Caltoris aurociliata (El. and Edw.), from Sikkim.
Caltoris plebeia (de N.), from India, Burma.
Caltoris tulsi (de N.), from Sikkim, Assam.
Caltoris austeni (M.), from Sikkim, Assam, Burma, China.
Caltoris onchisa, Swinh., from Assam.
Caltoris cahira (M.), from the Andamans and Nikobars.
Caltoris moolata (M.), from Burma, Perak, Malay and Archipelago, Tonkin.
Caltoris pagana (de N.), from Sikkim, Assam, Burma, Borneo, Sumatra.
**Caltoris conjuncta* (Herrich-Schæffer), from India, Ceylon, Hongkong, Malay Peninsula and Archipelago.
Caltoris assamensis (W.—M. and de N.), from N. W. Himalayas, Sikkim, Assam, Burma, Hongkong, Tonkin.
Caltoris (?) uma (de N.), from the Karen Hills, Burma.
Caltoris eltola (Hewits.), from N. W. Himalayas, Sikkim, Assam, Chin Hills, China.
Caltoris discreta (El. and Edw.), from Assam, Sikkim, Burma.
Caltoris contigua (Mabille), from India, Burma, Malay Peninsula and Archipelago, Hongkong, Tonkin.
**Caltoris colaca* (M.), from Sikkim, Assam, S. India, Burma, Ceylon, Andamans, China, Malay Peninsula and Archipelago.
Caltoris bevani (M.), from India and Burma.
**Chapra mathias* (F.), from India, Ceylon, Burma, China, Japan, Malay Peninsula and Archipelago.
Chapra midea (Walker), from Turkey, Egypt, Sind, Kutch, Western India.
**Chapra subochracea* (M.), from India.
Chapra brunnea (Snellen), from Java, Sumatra, Burma, Sikkim, S. India.
Chapra sinensis (Mabille), from India, China.
**Parnara canaraica* (M.), from Kanara, S. India.
Parnara guttata (Bremer and Grey), from N. W. Himalayas, Sikkim, Assam, China, Japan, Corea.
**Parnara bada* (M.), from India, Ceylon, Burma, Formosa, Hongkong, Malay Peninsula and Archipelago.
Parnara vaika (Plœtz), from S. India.
Parnara flexilis (Swinh.), from Poona.

A most difficult lot to deal with and Swinhoe has made a valiant effort to unravel them in *Lepidoptera Indica,* pages 294 to 332 with plates 825 to 834. It will have to stand at that until all the stages of the insects have been worked out and properly studied. The species marked with an asterisk (*) are those that will be treated below. Notes will be made about others that may seem to occur within the Plains of India. *Caltoris seriata* is certainly a different species to *kumara* although Swinhoe considers them, seemingly, to be one and the same. Davidson, Bell and Aitken in their papers in this Journal in 1897 called what is really *seriata* by the name of *kumara* (and even called it *philippina*) while what is really now *kumara* they called *plebeia.* There is no *plebeia* in N. Kanara District in the Bombay Presidency. It is an easily recognized species because of the presence of 'a long tuft of greyish hairs on the hinder margin of the forewing before the middle, curling upwards and outwards and lying flat against the wing' (*Lepidoptera Indica,* vol. x, p. 302).

Genus 30.—BAORIS

Subgenus—*Baoris*

Imago.—Of large size comparatively. Very rapid in flight, frequenting shady jungles in the hills where there is heavy rainfall.

Antennæ.—With the club comparatively elongate, the terminal crook, short, as long as, or slightly longer than the width of the club.

Palpi, Hind tibiæ.—As for subfamily.

Forewing.—Immaculate or with semihyaline spots. Venation as for subfamily. In the male, on the underside, there is large, silvery space in the middle of the underside stretching from the inner margin to vein 2 and bottom of cell with a longitudinally-oval patch of furry dark-brown scales in the middle of it on each side of vein 1, this black patch 2 mm. by 1 mm. while the silvery space is 5 mm. long by over 4 mm. broad.

Hindwing.—Immaculate. Venation as in subfamily. On the upperside, in the male there is a 5 mm.-long tuft of dark-brown hairs growing down and outwards from the upper margin of cell and covering the whole of the cell as also a furry patch of blackish scales within it that practically fills it.

Egg, larva, pupa, habits.—As for the subfamily.

223. **Baoris farri** (M.).—Male. *Upperside* dark violet-brown with bronzy tint. Forewing: seven or eight white, semihyaline spots: two near end of cell, well-separated, the lower slightly inwards touching the lower margin; three subapical, the largest half the size of the lower cell-spot, in interspaces 6, 7, 8 in an outwardly-oblique curve, the uppermost a mere dot and in the exact middle of interspace; also an inwardly-oblique series, the uppermost in interspace 4 at the middle of that interspace near vein 5, a dot; the second, quadrate and larger than either of the cell-spots, just before the middle of interspace 3 with the lowest inwards, well out from base of interspace 2, largest, sometimes trapeze-shaped and sometimes also excavated on the outer edge. Some decumbent, brown hairs in interspace 1 from base to about end of cell and a slight fringe of hairs along inner margin. Hindwing immaculate; the sex-tuft blackish-brown with the base pale; a fringe of longish, brown hairs all along vein 1*b* nearly to outer margin, spreading into interspaces 1*b* and 1*a* above and below the vein. *Underside* paler than upperside, slightly ochreous, the marking the same. Forewing with the middle area silvery from and over the inner margin with the oval, dark, furry space or spot in the middle of the silvery area; some longish, decumbent, brown hairs from upper margin of cell directed down over upper half of cell-area. Hindwing immaculate, the base of interspace 1*a* pale.—Female. Like the male but the spots, larger, that in interspace 2 usually somewhat produced outwards along vein 2. Besides this there is always a smallish spot about the size of the cell-spot above and touching the middle of

vein 1 and there may be a tiny dot in interspace 1 just below the larger spot of interspace 2 and, even, an extra spot above the subapical three in interspace 9. *Cilia* very pale-brown with base somewhat darker, whiter near the tornal angle on the forewing upperside; of the hindwing upperside similar; underneath brown on forewing, whitish in the hindwing. Antennæ black, whitish on the underside with black specks at each joint; base of club whitish below, the tip rather longly reddish. Palpi, head and body more or less concolorous with wings above, the thorax with a grey-greenish tinge on dorsum, the abdomen with the tip ochreous; below concolorous with wings but pectus greyish, palpi ochreous at base; legs with the ends of tarsi ferruginous-tinged, the rest brown. Expanse 45 mm. or less.

In a lot of the specimens bred in North Kanara, Bombay, the males have a spot also just above the middle of vein 1 on the upperside of the forewing but, when present, it is always tiny and the underside of the female forewing shows this spot always blurred though very little diffused on the somewhat pale background which is never silvery as in the male.

Egg.—From memory, no description having been kept, this was very much like any of the others of the baorine group; high-dome-*shaped;* the *surface* smooth, rather dull and without sculpture; the *colour* of a whitish dead bone.

Larva.—The *shape* is that of Fig. 3 on the uncoloured Plate II at the commencement of these papers, the larva there depicted being that of *Baoris (Caltoris) conjuncta*, Herrich-Schæffer. The body is thickest in the middle, evenly thinning to both ends, more to the rather thin neck than to the other end; as a matter of fact it thins very little in lateral outline to the broadly-rounded, somewhat flattened anal segment; the claspers and prolegs are short, kept well under the body, the ventrum is flattened: the anal segment is broadly semi-circular, slightly thickened round the free margin, the anterior moiety transversely convex with the dorsal slope about 20° to the longitudinal axis of body and very slightly constricted at the front margin; *head* much broader and higher than segment 2, rather longly semi-circular in shape with a slightly depressed, dorsal line over vertex to apex of clypeus, the face somewhat convex; the surface of the head superficially cellular-rugose, covered with short, fine, whitish hairs that are all erect and hardly as long even as half the breadth of clypeus, some about the mouth-opening, especially below, double that length; the true clypeus is about half the height of face and rather under one and a half times as high as broad, the apex acute; the lateral borders thinly black with a thicker, dorsal, black line in the middle that does not quite reach the apex from base; the false clypeus outside it reaches two-thirds the height of the face and has the apex acute, a strip on each side of true clypeus not as broad as one-quarter the breadth of true clypeus-base, starting from the very corner of the true clypeus-base and broadening out somewhat convexly-outwards to middle, then again converging towards dorsal line, this false clypeus also thinly black-bordered with its dorsal line black too; labrum one-third of the length of true clypeus by four times as broad as long, somewhat curved concavely forwards, transparent-glassy with the middle of front margin brownish; ligula kidney-shaped, about the same length as labrum and nearly as broad but bent strongly in the longitudinal direction, the sinus on the front shallow, transparent-glassy showing the black ends of mandibles through as a dark, dorsal line; antennal, basal joint white, third joint orange or reddish; mandibles strong, light-rusty with rather broadly black ends, the cutting-edges absolutely entire; the eyes arranged with 1 to 4 in a very slight curve, all of equal size and spaced a good eye-diameter from each other equally, number 6 in a straight line with 3, 4 and nearly four diameters further down, 5 behind, three eye-diameters from 4 and rather less than that from number 6, all slightly prominent, glassy surrounded thinly blackish; colour of head whitish with a broad, black band separating the face from the cheeks on each side meeting on vertex, including the eyes and with a branch running from vertex down the dorsal line of face to the apex of false clypeus, then very thin to apex of true clypeus and down the same line thicker to base of true clypeus, sometimes this line in true clypeus somewhat interrupted near apex; both the false and true clypeus thinly outlined black. *Surface* of body covered with minute, erect, soft, white hairs that are longer round the free margin of anal flap; the usual impressed, fine, transverse lines, six in number, in front of hinder margin of each segment to about half the length of the segment forwards; there is a curious, low, circular, concave tubercle under each spiracle with some longer hairs on it. *Spiracles* whitish, oval, flush, rather small;

those of segments 2, 12 twice as large as any of the rest. *Colour* of body white with a greenish tinge; spotted or dotted all over with green dots; the impressed, transverse line region tinged with yellow on each segment; ventrum whitish with a slight blue-green tinge. L: 44 mm.; B: 6 mm. just before the middle.

Pupa.—This is the *shape* of Figure 3*a* on Plate II; it is circular in transverse section from shoulders to segment 10 and hardly different in diameter between those points; after segment 10 it narrows quickly to the 3.0 mm.-long, spatulate cremaster that is 6× as long as segment 13 and nearly 2× as long as 12 (12 is 1.8 mm.; 13 is 0.4 mm. long); the cremaster is curved downwards and the whole of the dorsum in deeply channelled out from end to end, the channel even continued forwards onto 13 leaving to decreasingly broad margins on the cremaster outside—the cremaster is 2.2 mm. broad at base (front margin) and 0.4 mm. just before end, the channel is 0.8 mm. broad at middle, the margin left on each side 0.8 mm. broad at base, about 0.2 mm. just before end; the head-point is 2.4 mm. wide just before eyes and 0.4 mm. at end, being 3.4 mm. long; the dorsal slope of thorax and segment 2 is about 30° to the longitudinal axis; segment 2 is a transversely-oblong piece about the same length as 12, thorax is as long as $4+5+6$ together, $4=5$, segment $6=4+5=7=8=9=10=11$; the hinder margin of thorax is a curve between a quarter circle and a semi-circle meeting the wings in a deep, somewhat broadly-rounded angle of 90°; the shoulders are quite evenly rounded, not prominent; the *head* has the eyes not prominent, the clypeus triangular, the ligula small, diamond-shaped, the proboscis produced beyond the end of wings to the end of the cremaster or nearly; the mid legs reach to two-thirds the length of wings, the forelegs to about half the length of wings. *Surface* of pupa shining and minutely, irregularly, superficially wrinkled transversely; besides the surface except wings is covered with minute erect hairs of 0.05 mm. in length and spaced rather more than their own length; the head-snout is wrinkled rather more strongly on the cylindrical distal half than any other part. *Spiracles* of segment 2 indicated by a very slight production forwards in a lobe of the front margin of segment 3, this lobe being dirty-whitish; the other spiracles are about 0.3 mm. long by 0.1 mm. wide and are pointed ovals, flush with the surface and light-yellowish in colour; beneath each spiracle there is a perfectly circular, shining space or spot, a couple of spiracle-lengths off and in front that is 0.1 mm. in diameter. *Colour* of pupa is a watery grass-green, powdered more or less with white waxy powder excreted by the larva, with a darker-green dorsal band; cremaster transparent-glassy. L: 35 mm.; B: 6 mm.

Habits.—The little egg-larva has a black head. It lives in a cell made at the side of a leaf by turning over, at first, a little oblong piece onto the top and fastening its edge and one end, making a little sylindrical tube; when grown large it makes a cell by joining the edges of a leaf more or less firmly coating the inside of it with silk. Pupation takes place on the underside of a leaf, the larvæ sitting along the midrib and drawing the edges together only very slightly, never joining them, with two threads, one in front, the other behind; in this hollow pupation takes place quite in the open to speak and the pupa is attached by the tail and a tight body-band; the hollow is powdered with white powder that the caterpillar excretes when about to pupate from glands situated on the sides of segments 9 to 11—probably from the little tubercle-bodies noticed in the description of the larva, subsisting over into the pupal state as little circular, shining, 0.1 mm.-wide spots (noticed above). The butterfly is found on the Western Ghats in Kanara, in heavy jungle where bamboos flourish and it has never been seen in open country. It flies powerfully and high; rests often on bamboo-leaves by paths in the early morning, sitting with its wings closed over the back on the top of a leaf; and is then sluggish because probably somewhat numbed from the cold of the night. Larvæ have been obtained close to the sea on the hills as well as further inland and above the Ghats. The foodplant of the larva is bamboo. The first were on a large-leafed species called *Ochlandra talboti*, Brandis; but, afterwards, many were obtained also on *Bambusa arundinaceæ*, the common large species in Southern India. Swinhoe gives the habitat as Sikkim, Assam, Bengal, Kanara, Ceylon, Andamans, Burma. He says further that :—'The types (females) are from Calcutta and Cherrapunji; Elwes records it from the Naga Hills, Sikkim at 5,000′ and Tavoy; Watson from the Chin Hills and Tilian Yaw; Manders from the Shan States. The type of *penicillata* is from Ceylon, of *scopulifera* from the Andamans; of *sikkima* from Sikkim.' (*Lepidoptera Indica*, p. 299—on Pl. 825 the butterflies are depicted in Figures 1 to 1*d*, the larva and pupa in 1*e*).

Sub-genus—*Caltoris*, Swinh.

224. **Baoris (Caltoris) kumara**, (M.).—Male. *Upperside* dark olive-brown. Forewing with six semihyaline-white spots in a continuous series, commencing with two (or three) subapical in the usual curve and mere dots, the three discal ones in interspaces 4, 3, 2 inwardly-oblique, the uppermost a mere dot, the lowest about 1 mm. square, the outer edge generally sloping outwards; and a small, blurred dot or spot, sometimes absent at the middle of vein 1, just touching it above. A powdering of yellow hair-scales on costa above vein 12 and covering the whole cell; some longish, decumbent, ochreous hairs below the cell from base of interspace 1 and out in the upper half of it as far as end of cell; a dense covering of similar hairs in the space between inner margin and vein 1 to well beyond the middle of margin and a fringe of short hairs along the inner margin. Hindwing immaculate; a covering of decumbent, dark-brown, long hairs in upper part of cell and out to outer margin with lighter-brown, ochreous-tinged hairs on the rest of wing, those along vein 1*a* very dense. *Underside* somewhat paler, ochreous-tinted. Forewing with the area from base including the cell, down to inner margin and out to the outer margin at tornus and inside a line joining tornus to the uppermost of the three discal spots in interspace 4 blackish with the spot on vein 1 distinct, very much larger than on upperside but blurred with, sometimes, a pale indication of another above it. Hindwing uniform, the base of interspace 1*a* pale.—Female. Like the male but paler, the hairs on the *uppersides* of wings more ochreous; often, on forewing, a subhyaline-white dot-spot just under the outer half of the lowest discal spot, in interspace 1 not quite touching vein 2. On the *underside* this little spot is quite large and blurred, diffused and the spot below it is generally very much larger and longly diffused-pale inwards; on the hindwing *underside* there is a white dot always towards the base of interspace 2, never, apparently, present in the male. *Cilia* above and below on both wings usually very pale-yellowish, sometimes yellower. Antennæ black, the end of shaft and base of club beneath yellowish; there are some yellow specks at joints beneath; the tip of the club is very dusky-velvety (instead of, as in most skippers, reddish). Palpi brown above (not visible), ochreous strongly mixed with brown hairs on sides and below; third joint brown. Head and thorax brown mixed with ochreous hairs, often with a bloom; beneath ochreous mixed with brown, the legs pinkish-brown ochreous. Abdomen brown above mixed with ochreous and with obscure darker-brown segmental bands; below ochreous. Expanse 45 mm. at the most.

This species was called *plebia* by Davidson, Bell and Aitken and, later, *philippina*, when it was discovered that the former species is at once distinguishable by the male having, on the underside of the forewing, a tuft of hairs on the inner margin lying against the wing-surface and directed upwards. Their *kumara* (*Journ., Bom. Nat. Hist. Soc.*, vol. xi, 1897, p. 58) now turns out to be *seriata*, M., the next species described below.

Egg.—Highly dome-*shaped*. Surface dull, smooth, without sculpture. *Colour* that of a pinkish, dead bone.

Larva.—The body is of the same *shape* exactly as that of *Baoris farri;* circular in transverse section, fining to the rather small neck and much more gradually to the very broadly-rounded (it is semi-circular) anal segment; this anal segment has the free margin thickened, the thickening about one-quarter the length of the radius of the semi-circle and the dorsum inside this thickened margin is slightly convex transversely, sloping from front to extremity, very slightly pitted and quite bare of hairs while the margin has a fringe of erect fine, short, white hairs all along it, these hairs being about as long as the width of the thickened margin but some a little longer than others—the hairs of the body elsewhere are far shorter than these; prolegs, claspers and true legs very short, the claspers and prolegs held well under the body and green like the flattened ventrum; *head* is a somewhat high semi-circle, the vertex very widely rounded and hardly bilobed, the face slightly convex with the dorsal line somewhat widely depressed to apex of clypeus; the surface of head is somewhat superficially cellular-rugose and covered with extremely short, light, fine, erect hairs none of which are even as long as half the breadth of true clypeus except round the mouth-opening at sides and underneath where they are comparatively a good deal longer; the colour of the head is soiled whitish, often flushed with a tinge of brown in very heavily-marked specimens, with a very broad, black band all round it including the eyes; from this encircling, black band a dorsal band starts on vertex and runs down to apex of clypeus, is continued thinly to apex of true clypeus and again down the middle of that to labrum; often the encircling band is very broad and the other black markings more pronounced—there is also, in all specimens, a thin black line outlining both the true and false clypeus—and, even, a black, short flush upwards from the middle of the sides of clypeus to the middle of each lobe-face; the true clypeus is triangular, the apex acute, a little less than half the height of head, white with the sides thinly black, the dorsal line more broadly black; the false clypeus similar, reaching 0.3 mm. further up, the sides very slightly convex outwards, outlined thinly black also; the labrum is a transversely-oblong piece of 0.5 mm. long (the true clypeus is 1.35 mm. long by 1.2 mm. broad) by 1.2 mm. broad, the hinder margin absolutely straight, the front margin quite as long and emarginate widely in a curve; the ligula is squarely kidney-shaped, white like the labrum, 0.5 mm. long by 0.7 mm. wide with a frontal rounded sinus about one-third the width (rather less) and 0.15 mm. deep leaving a broadly-rounded lobe on each side; there is a 0.55 mm. long hair at each anterior lateral corner and another on the front edge more inwards of the same length on labrum and, on the ligula, there is a row of six hairs on each side of the sinus to the lateral-anterior corner, all about equally spaced considering each six as one group, the outermost three about 0.5 mm. long, on the extreme edge, the two next inwards shorter, removed away from edge somewhat, the innermost shortest and removed from the dorsal line by a distance rather greater than its own length (which is about 0.2 mm.); antennal, basal joint colourless as also the third; mandibles strong, 1.2 mm. broad, oval in section, the biting-ends quite entire, highly shining, lightish yellow-brown with ends very dark; eyes arranged: 1, 2, 3, 4 in a slight curve, equal in size and equally spaced, rather less than an eye-diameter apart, 6 in a straight line with 3, 4 but nearly four eye-diameters from 4 with number 5 behind forming an equilateral triangle with 4 and 6. *Surface* of body dull, the segments quite plainly expressed, with 6 impressed lines parallel to hinder margin attaining, the 6th, to about the middle of each segment; covered with minute, erect, light hairs about 0.05 mm. in length and spaced about 0.1 mm. apart; also a 0.1 mm.-wide, circular, disc-like tubercle below and slightly behind each spiracle. *Spiracles* longly-oval, whitish, nearly four times as long as wide; those of segments 2, 12 much larger. *Colour,* greenish-white with a whiter, broad, subdorsal band occupying the space between the subdorsal (theoretical) and the dorsolateral lines of the body; the ventrum and prolegs greener. L: 40 mm.; B: 5 mm.; B of head 3.5 mm. by 4 mm. high.

Pupa.—This is also exactly the same *shape* as that of *Baoris farri,* that depicted in Figure 3*a* of Plate II; with the same sort of snout in front between the eyes, the same type of bent-down, spatulate cremaster with a rounded, semi-circular end, the radius of the semi-circle being about one-sixth as long as the width at front margin of segment 14, the dorsum right back into 13 even deeply hollowed out leaving on each side a margin about half as wide as the hollow, this channel or hollow long-oval in shape; ventrally, the cremaster is flat as far forwards as the clasper-scars and on each side laterally there is a slight extensor-ridge; segment 13 is about a third of the length of 12 and the proportions of the segments are exactly the same as in the pupa of *B. farri;* the *head* has the snout about the length of head-vertex and segment 2 together; the clypeus and ligula as in that species also; the proboscis reaches to end of cremaster or at least to end of 13; the midlegs reach three-quarters the length of wings, the forelegs over a half the length of wings; the eyes have the crescent linear and slightly behind the middle of the eye. *Surface* as in *B. farri,* with a similar hair-covering and similar tiny shining circular disc below each spiracle. *Spiracle* of segment 2 also as there, and the other spiracles also as in that insect. *Colour* similar also. L: 30 mm.; B: 5 mm.

Habits.—The habits as to oviposition are those of *B. farri;* the caterpillar behaves in exacty the same way, making a cell at first at the tip of the leaf by joining the edges, coating the inside of it with silk; renews the cell as required by feeding and growth in stature. The pupal cell is also similarly made, quite open, and the pupa is fastened by the tail and a body-band. The larva excretes a white, cereous powder as in *B. farri* which is always found more or less plentifully on the pupa and in the cell. The tail is fixed to a short length of silk rope fastened down at both ends on the pad at right angles to the longitudinal axis of body. The larva is very sluggish at all times but wanders out at night to feed; it lies inside the cell during the day with the front segments contracted a good deal, the head flattened back with the mouth directed forwards. The growth is normal and the duration of the pupal stage also. There must be a slack time during the hot weather when the growth must be slower or there must be an interval tided over in some way when the bamboos lose their leaves. It is probably passed in the larval state as noted for *Tagiades litigiosa.* In the monsoon months caterpillars are quite plentiful in N. Kanara from sea-level up to the highest hills wherever there is forest and the rainfall is sufficient. The species is not found in the plains. The butterfly is a strong flier that has much the same habits as *B. farri* and is found in the same places in Kanara. Swinhoe gives the habitat as S. India and Ceylon and says the types came from Kanara in S. India; adding 'the type of *seriata,* a female, from Ceylon (it is undoubtedly a female of *kumara*); we have both sexes from Karwar and Kandy; it is very nearly allied to *philippina,* Herrich-Schæffer from the Philippines, but is a larger insect; we have both sexes from the Nilgiris; Evans records it from the Palni Hills and de Nicéville from Calcutta.' (*Lepidoptera Indica,* vol. x, p. 301; figures of the male 1, female 1*a,* underside 1*b* and larva and pupa 1*c* are contained on Plate 826). The foodplant of the larva is any species of Bamboo.

Since the days when this was written about *seriata* many specimens of it and *kumara* have been bred side by side in Karwar in N. Kanara and it is very evident that they are two quite different insects although, except for the colouring of the heads and a slight difference in its shape and size, the larvæ are exceedingly alike. As will be seen by what follows.

225. Baoris (Caltoris) seriata (M.).—Male. *Upperside*: olive-brown of a very dark shade when fresh, fading a bit with age with a very faint tinge of russet that is hardly remarkable except it is compared with a male of *B. kumara.* Both wings as in *kuamara* with the identical same spots both in size and shape, in number too as there may be a fourth speck in interspace

9; but, here, the spot in interspace 1 just above vein 1 may occasionally be completely absent and the one above it is *never* present even on the underside; the decumbent hairs and the fringe along inner margin also the same in forewing. *Underside* as in *kumara* but very distinctly russet or rusty especially on the hindwing; on the forewing the single spot in interspace 1 is always sagittately (like an arrow) emarginate and never as diffused as in that species; in the hindwing there may be a white dot in the middle of interspace 2 or not.—Female. *Upperside* as in *kumara* in every way but without the slight rusty tinge of upperside of male *seriata;* the spot in interspace 1 just above vein 1 often arrow-shaped, that is with the outer edge triangularly sharply excavated. *Underside*: forewing has the spot in interspace 1 very slightly only diffused, much better defined than in *kumara* female, sagittate, the spot above it under vein 2 always invariably present, short, linear, directed obliquely inwards from the outer-lower corner of the spot of interspace 2 to the outer, upper corner of the arrow-shaped spot. Hindwing similar to that of male, a white dot in interspace 2 and sometimes 3 as well. *Cilia* as in *kumara,* perhaps a little paler. Antennæ also as in *kumara* as are the palpi, head, thorax and abdomen, as well as legs; but the antennæ are ochreous below all along the shaft as well as at the base of the club with small black tips below at the joints, the ochreous colour too somewhat invades the sides, especially at the club, leaving only the very back black. Expanse up to 45 mm. or occasionally even more in the female.

Egg.—Exactly as for *Baoris kumara*; same size, same colour and everything.

Larva.—The body is cylindrical in *shape,* fining off a little to the head from the middle where it is fattest, more quickly in segments 5 to 2; fining off hardly at all backwards to hinder margin of segment 10, then slowly to anal segment which has the dorsal line somewhat sloped and is large, shaped like a semi-circle upon a shortly-oblong, transverse basal piece; the semicircular part is the anal flap and it is transversely evenly convex, becoming flatter towards the extremity which is hardly at all thickened and applied to the resting surface, overreaching the claspers by half its length; segment 13 is short, transverse, about one-quarter the length of 12 or 14 which are co-equal and it is shortened laterally in the spiracular region so as to be there nearly non-existent; claspers and prolegs very short, fleshy, with circular feet—the larva generally lies with the ventrum pressed flatly against the surface so that the legs hardly show at all; *head* is in shape a slightly lengthened semi-circle, broadest at middle, somewhat narrowed above, the face somewhat convex, the dorsal line very narrowly, shallowly depressed as far as the apex of clypeus; the surface of head is rugose with little shallow cells all over superficially but distinctly, leaving a broad space along clypeus curving round to the eyes and extending a little up on each side of dorsal line quite smooth; the whole surface is shining and covered all over with a clothing of the minutest, light, erect hairs imaginable, a few about eyes and the one at the extremity of antenna much longer, the minutest about 0.05 mm. long the one at extremity of antenna 0.6 mm., others about eyes 0.25 mm.; the true clypeus triangular, reaching about half the height of head, equilateral with the apex acute, the whole the colour of head with a deep-brown dorsal line down middle and outlined similarly; the false clypeus a moderately broad strip outside with its sides somewhat convexly out-bowed, its apex acute reaching two-thirds height of face; labrum transverse, its apex acute reaching two-thirds height of face; labrum transverse, its hinder margin straight, anterior margin very strongly triangular-emarginate, its length 0.45 mm. and its width 1 mm. like the clypeus, the colour greenish; ligula rather squarish, convex, 0.45 mm. long by 0.6 mm. wide with the emargination 0.1 mm. deep and 0.25 mm. wide, rounded, the colour also greenish; antennal, basal joint greenish, the third orange, mandibles of the block type, chestnut or dark red-brown, darker at ends, the cutting edges quite entire; the eyes arranged 2, 3, 6 in a staight line, 4 one eye-diameter from number 3, number 6 three eye-diameters from 4 with number 5 behind and about two diameters or more equally from 4 and 6, numbers 1, 2 joined (the line joining their middles) would meet the line 3, 4, 6 in an angle of 120°, number 2 being an eye-diameter from 3 and slightly behind line 3, 4, 6, number 1 rather less than an eye-diameter above 2; the colour of the head is white with a slight yellow tinge, ligula and labrum and clypeus as well as dorsal depressed line somewhat greenish, with a broad, blackish band completely surrounding the whole from and including the eye-curve to vertex and over it but not encroaching upon the face, the true clypeus outlined narrowly blackish with a dorsal line the whole length of this clypeus; the orange of third joint of antennæ slightly invades the bases of gulae. *Surface* of larva is dull, each segment with the usual six depressed, thin, transverse lines or folds taking up half the length from hinder margin forwards; the whole with some extremely minute, erect hairs, those round the free margin of the anal flap much stronger, longer, reaching 0.3 mm. long, quite a conspicuous fringe. *Spiracles* small, oval, flush, opaque white, those of 2 and 12 much larger. *Colour* greenish-white, segments 2 to 4 greener, whitest in a broad, subdorsal band, yellowish about segment-margins when constricted; true legs, prolegs, ventrum green, the last greenest; the body is flanged slightly along the dorso-ventral margin and there are patches of a cereous excreted powder under it on the common margins of segments 10 and 11 and segments 11 and 12 before pupation; the dorsal line between the whiter, broad, subdorsal bands pulsates slightly. The head is about the same diameter as segment 4. L: 40 mm.; B: 5 mm. at middle; diameter of head: 3 mm. or even 4 mm.

Pupa.—This is naked and green in colour like all those of the *Notocrypta-Baoris-Parnara* group; it is of exactly the same *shape* as those: circular in transverse section, thickest at middle, fining to shoulders very little and equally little to segment 11; the diameter is about the same at eyes as at shoulders and before eyes suddenly narrows into the conical base of a long, cylindroconical frontal process or snout that is porrect between the eyes, quite cylindrical in its distal third, more or less conical in the middle and quite conical at base; this snout is as long nearly as the thorax and very slightly bent down, the tip bluntly rounded; segment 12 is short and about half 11; segment 13 is about equal to 12 or, perhaps, rather shorter; 14 is a longly semielliptical piece, the edges raised dorsally leaving the space between depressed like a spout, the whole as long as 12+13, the extremity rounded and it is quite thin: segment 2 is about equal to 12 and has both margins straight, the dorsal line inclined forwards at about 40° to the longitudinal axis, merging gradually behind into the surface of the thorax which has its dorsal line in about the same plane that is continued back as far as segment 6, the highest point of pupa; the hinder margin of thorax is a semi-circular curve meeting the wings in an angle of about 50°. *Surface* quite smooth and even without constrictions except the very slight ones at the mobile segment-margins of 8/9, 9/10 and 10/11; under a strong lens it is covered with minute, short, erect, light hairs all over but nowhere at all densely; the proboscis is continued free beyond wings to the end of the cremaster. *Spiracles* are oval, flush, not small, more opaque-white than the pupa; those of segment 2 are slits with a slightly-raised, opaque-white, semioval surface of the same diameter as the length of slit on the front surface of thorax. *Colour* glaucous, translucent grass-green all over, a little more opaque on wings and segments 1 to 3; with a subdorsal, broad, whitish line. The cremaster is slightly down-bent, the suspesonry hooklets are very small, bunched at its very end ventrally. L: 30 mm. nearly including the head-point or snout which itself is about 3 mm.; the cremaster is also 3 mm. long; B: 5 mm. at middle.

Habits.—The egg is, as a rule, laid at the tip of the upperside of a leaf. The young larva eats the shell and turns over a bit of the edge onto the top to make the cell. Later on it joins the edges of a leaf together making a conical cell which it lines with silk. It is a close fit. The larva goes out to feed and renews the cell as necessary as it gets bigger. It pupates on the underside of a leaf fastening a few silks from edge to edge that, contracting, make a 'spout' in which it lies with its back towards the earth; fastening itself in by a body-band and a tail-pad, this tail-fastening consisting of a strong, short, transverse band attached to the pad, the hooklets of the cremaster being atached to its middle.

In *Lepidoptera Indica*, page 301, Colonel Swinhoe quotes the following remarks from 'Davidson, Bell and Aitken,' which as they were actually written originally by the present writer in 1897, are known to apply to this insect (*seriata*) and not to *kumara*, may be here repeated:—'*Baoris seriata* is a very common insect at all times and places in the N. Kanara District of the Bombay Presidency. It basks like the last (*Baoris farri*), but always on leaves; and is fond of flowers in the early morning; it is easily captured when basking as it returns to the same leaf, repeatedly, after being disturbed; it has a very rapid flight. We have bred many specimens at all seasons. It is not nearly so common close to the sea in Karwar as it is further inland in the big jungles. Colonel Swinhoe says 'The types are from Kanara, S. India; the type of *seriata,* a female from Ceylon (it is undoubtedly a female of *kumara*). . . .' is quoted already under *Baoris kumara.* Mr. Ormiston has published figures of the genitalia of both *seriata* and *kumara* in the *Report of the Proceedings of the Third Entomological Meeting* held at Pusa in February 1919, Plate 172, Figures 41 to 44 (*kumara*) and 45 to 48 (*seriata*) which show very considerable differences between the dorsal and ventral aspects of the tegumen in the two species in Ceylon. They correspond exactly with those of the two species in Kanara.

The *head* of *seriata* larva is 4 mm. broad by exactly the same in height if the prominence of the mandibles is taken in the height, if they are left out the height is only 3.6 mm. The true clypeus is 1.3 mm. in height by 1.1 mm. in breadth; the false clypeus reaches further up the face than the true one by 0.3 mm. and the greatest width of its somewhat outwardly-convex sides is 0.2 mm.; the labrum is perfectly straight along the hinder margin, the width measuring 1.1 mm., the lateral length 0.4 mm.; anterior margin of labrum widely curved-emarginate, its length in the dorsal line 0.25 mm. and its width exactly equal to the hinder margin; the length of the hair in the anterior, lateral corner of labrum is 0.475 mm. The great majority of the little hairs on the head are 0.05 mm. long but the longest about mouth-opening is 0.6 mm. and the one at the end of the third antennal joint is longest of all: 0.65 mm.; the third joint of antenna is 0.3 mm. long, rusty in colour with a 0.75 mm. long, double-jointed apendage beside the long hair on its apex. The eyes of the head are each 0.125 mm. in diameter and prominent; the topmost eye 0.01 mm. from the second which is an equal distance from the third; the fourth is 0.15 mm. from the third, the sixth or lowest is 0.4 mm. from the fourth; the fifth is 0.4 mm. from both fourth and sixth. If all this is compared with similar measurements given for *kumara* it will be seen that there is very little to be got out of them to indicate that they are different species. Here in *seriata* the head is a bit shorter, not so high but broader. Which is not very much to go on. Absolutely the only difference between the two larvæ is that the head of that of *kumara* is very much more heavily marked with black than that of the other.

226. Baoris (Caltoris) conjuncta (*Herrick-Schæffer*).—Male. *Upperside* 'dark olive-brown. Forewing with nine semidiaphanous, yellowish-white spots: two in the cell towards its end, one above the other, well-separated, touching the margins of cell; three small subapical spots of equal size in an outwardly-oblique, well-curved line; the others in an inwardly-oblique, discal series, one in each interspace, the spot near the base of the first median interspace being largest, its lower end produced outwards; the spot above it about half its size and with its outer-lower end also somewhat produced: the uppermost, small spot about the size of the subapical ones; a spot at the middle of vein 1. Hindwing with two or three small, discal spots and a white spot near the upper end of the cell. *Cilia* of forewing cinereous, of hindwing whitish with cinereous base. *Underside* paler. Forewing with the spots as on the upperside. Hindwing with a small, white spot near the upper end of cell and a discal series of small, white spots. Antennæ black, the tip of the club pale-red, the shaft and club on underside whitish, the shaft spotted with black; palpi, head and body concolorous with the wings; palpi beneath whitish, legs tinged with dull red.—Female like the male, the spots on the forewing usually larger and, consequently, closer together; the largest spot of the discal series usually much larger. Expanse 40 mm. to 47 mm.' (Swinhoe, *Lepidoptera Indica,* vol. x, pp. 309-310).

In a fairly large series bred in N. Kanara District of the Bombay Presidency the males on the *upperside* forewing have the costa above vein 12 sprinkled with thin, ochreous-yellow scales, the lower half of the cell nearly out to the spot in it and below the cell in interspace 1 as far as base of vein 2 set with decumbent, yellow hairs which also occupy the inner margin upwards to vein 1; and there is a slight fringe of brown hair along the inner margin; also, occasionally, there is a tiny extra dot above the three subapical ones as well as a tiny dot underneath the largest discal spot in interspace 1 Hindwing with the upper half of cell and outwards above vein 6 set with purplish-tinged, decumbent hairs; underneath cell and including the lower half of it from base to very nearly the outer margin of wing the surface is set with ochreous, decumbent hairs very densely at base and all along vein 1*a*; the discal dot-spots are in interspaces 2, 3 and 4; the spot in the cell is rarely visible. *Underside* forewing with the spots all as on upperside with that in interspace 1 always somewhat blurred along the outer border and, nearly always, with the little spot above it even when it is not present on the upperside. Hindwing with white dot-spots in interspaces 2, 3, 4, 5 and 6, that in 5 always tiny and sometimes wanting. The undersides of the female hindwing is often shot with a distinct purplish-blue sheen or tint.

Egg.—Is of the ordinary type of the genus: dome-*shaped;* the *surface* finely frosted-looking, smooth, slightly shining; *colour* whitish. It is broadest at the surface of attachment. B : 1.5 mm.; H : 1 mm.

Larva.—Is, in *shape,* exactly the same as those of the genus: head large compared to segment 2; body about the same breadth from segment 4 to segment 12, the dorsal line between these points nearly straight, the ventral surface flattened; the head generally, when the larva is at rest, held with the mouth well forward, the top pressed back against segment 2, the front segments drawn together considerably and, therefore, the dorsal portion of segments 3-5 somewhat prominent; the anal end always flat on the resting surface, the legs and prolges short; segment 13 considerably less than half segment 12 in length; segment 14 less than segments 12 and 13 together, semielliptical in shape, broadly rounded at extremity, sloping with segment 13 at an angle of less than 30° to the longitudinal axis. *Head* curvilinearly equilateral-triangular with the apex rather narrowly rounded and with a small, triangular sinus in the dorsal line which is afterwards depressed slightly as far as the apex of the clypeus; the face somewhat convex; the true clypeus longly triangular, about half the height of face; the false clypeus an even strip outside it, nearly two-thirds the height of face, likewise triangular and rather difficult to trace whereas the true clypeus is indicated by a fine, somewhat dark line, the surface is finely cellular-rugose and covered with minute, erect, fine, whitish hairs all over, the main dorsal, dorsolateral and lateral hairs somewhat longer, also erect, light and fine and some longer hairs about the borders of mouth and base of gulæ; the labrum small, arc-shaped, whitish-translucent; the ligula moderately large, glassy-white, semi-circular with a shallow, rounded sinus and the lobes bordered with hairs in front; the antennal, basal joint whitish, the second rusty-red; the mandibles blackish with their bases rusty; the eyes four in a curve, the three uppermost rather closer together, the sixth much further down, the fifth forming an equilateral triangle with 4 and 5, behind them; colour whitish with a large, black, circular spot on each lobe towards the upper face and another, similar lower down in front of the eyes, and a larger, quadrate spot about half way up at hinder margin on each lobe (which may be absent) and a black triangular mark on vertex of head in dorsal line. *Surface* of body dull, covered with minute, light, fine, erect hairs in the same manner as the face or head; 6 or 7 fine, depressed, transverse lines parallel to and in front of the hinder margin of each segment, the spiracular region somewhat corrugated, the margin (free) of anal flap slightly tumid; this free margin of anal flap set with a rather dense fringe of hairs of co-equal length, much longer than the hairs on the surface of body generally. *Colour* light sap-green suffused whitish, the ground-colour showing through in very numerous, roundish dots or spots which each bear one of the minute hairs; a longitudinal, broad, dorsal band of opaque white from segment 2 to anal end with, sometimes, a slightly darker, much narrower, central band; and a thin, white, spiracular line; ventrum light green. L: 40 mm. when stretched; B: 5 mm.

Pupa.—The *shape* is the same as that of the genus: *head* with prominent eyes, square in front, parallel-sided, with a long snout pointing straight out in front; this snout cylindrical in its distal two-thirds and its base filling up the frons between the eyes, truncated at tip and finely rugose transversely, as long as the head and 2 together; segment 2 is a short, transverse piece 1.5 mm. long, the thorax 5.5 mm. long both ascending at an angle of 20° or so to the longitudinal axis of the body; the thorax is only very slightly humped-convex longitudinally running smoothly into the dorsal line of abdomen, its front margin straight, the shoulders evenly-rounded and in no way prominent, its hinder margin a short parabolic curve meeting the wings in a broadly-rounded, deep angle of 90°; segment $4=5=$ half $6=1$ mm.; segment $7=2$ mm.; segment $8=2.5$ mm. $=9=10=11$ with segment 12 again just 2 mm.; segment 13 very short, hardly a fourth of 12; the cremaster about 3 mm., spatulate, bent down considerably in a curve, the end somewhat narrowly rounded, bearing the bunch of very short, hooked shafts at its very extremity, its dorsum largely hollowed out in the form of a wide, deep channel leaving narrow lateral borders decreasing in width backwards with the proximal half of sides also slightly hollowed out, the distal half ventrally quite flat; transverse section of body from shoulders to 12 is circular; *head* with a rather large, hexagonal clypeus quite ventral at base of snout, followed by a diamond-shaped ligula as long as clypeus and twice as long as broad; the proboscis free beyond wings to end of cremaster and, sometimes, even further; the midlegs reaching three-quarters of the wing-length, the forelegs half the wing-length, the antennæ between the two; the eyes are not prominent and have the crescent linear and just behind the middle. *Surface* shining and covered with 0.05 mm.-long, erect, white hairs that are not visible to the naked eye; segments distinct; abdomen and thorax transversely minutely, superficially wrinkled, segment 2 more confusedly, the snout more coarsely. *Spiracles* of segment 2 are somewhat convex, oval spaces as long as the adjacent antenna is broad, making a small lobe to front margin of thorax; the rest are oval, rather pointed at both ends, yellow like the lobe of spiracle of 2, more than twice as long as broad, about six spiracle-lengths to a segment length. *Colour* is a darkish sap-green with a subdorsal, broad, white longitudinal line the whole length of the body; laterally a bit whitish. L: 40 mm. over all; B: 7 mm.; snout 4 mm. long.

The same little round disc-tubercles noticed in larva and pupa of *Baoris kumara*, etc., are also present here in larva and pupa.

Habits.—The egg, always laid single, is invariably deposited on the underside of the blade of coarse grass or bamboo. The little larva makes a cell at the tip of the blade by drawing the edges together: a cylindrical cell and eats along the edges further up. When full-grown this cell is very laxly made and, of course, takes most of the blade of grass except when the grass happens to be of a very large species—these are mostly chosen in preference to small-bladed species. When about to pupate, the larva gets onto the underside of a blade, lies fully stretched and draws the edges slightly together by spinning a few silks across at the ends and in the middle so as to make a half-tube, spins a pad of silk at one end on the midrib to which it attaches its anal end and fixes itself further by a fairly tight body string or band over segment 4 or 5; there is always a little white, cereous powder round the tail-pad. The pupa lies thus quite exposed from below. The growth of the larva is fairly rapid; the duration of the pupal stage is normal. The imago is a very strong, rapid flier, fond of sitting low down on leaves or even on the ground; likes shady places although it is found practically everywhere in Burma and Central and South India, in jungles, hills and plains, in regions of heavy rainfall as well as fairly light rain from sea-level up to two or three thousand feet. The flight is often quite straight, sometimes in jerks and curves and insects are fond of returning to the same resting-place; they fly chiefly about 11 o'clock in the day and visit flowers quite freely. The distribution is given as Kangra, Burma, Central and South India. Butterflies are very plentiful after the monsoon months in Kanara (Bombay) District along the borders of roads, paths and open spaces. A common foodplant is *Saccharum*.

227. **Baoris (Caltoris) colaca** (M.).—Male. *Upperside* dark olive-brown. 'Forewing somewhat more produced than is usual in the genus with ochreous-white spots, all more or less small: three subapical, in an outwardly-oblique curve; a discal, nearly straight, inwardly-oblique series of four spots, the first and uppermost immediately below the lowest subapical and of about the same size as it, the next a little larger in interspace 3, the third the largest of all in interspace 2, its lower-outer edge produced, that edge somewhat curved with the fourth against the middle of vein 1, touching it above, about the size of the second (in interspace 3); in the type specimen there appear to be no spots within the cell, but in most examples there is a minute dot at the upper end and, in others, there are two well-separated ones, one above the other. Hindwing without marking. *Cilia* cinereous, brownish at base. *Underside* paler and duller in colour. Forewing with the basal half of its middle blackish, spots as above. Hindwing somewhat produced at the anal angle, a discal series of minute, white dots, varying in number in different examples. Antennæ black, the shaft dotted with white on the underside; the basal half of the club white beneath with extreme tip tinged red; palpi with black and white hairs above, pure-white beneath with a few black hairs; head and body above concolorous with wings; beneath, pectus and thorax whitish; abdomen beneath white with grey bands.' (*Lepidoptera Indica*, vol. x, pp. 316, 317).

In a long series of this species bred at different times in N. Kanara District of the Bombay Presidency where the rainfall is very heavy, there are the following differences:—*Upperside.* Forewing may have the spots in the cell or they may be completely absent or one of them may be wanting; the discal spot in interspace 4 is nearly always slightly larger than the lowest of the subapical dots and is generally the same size as the one in interspace 3 but is quadrate while the latter is produced at the lower end outwards like the largest below it; the spot in interspace 1 is sometimes as large as the one of interspace 3, sometimes smaller, or may even be completely absent. Hindwing has generally a tiny dot in interspaces 2 as well as 3. *Underside* always, except in very rubbed specimens caught outside, bright greenish-ochreous, The central area of forewing from inner margin upwards and inwards to base blackish as in Swinhoe's description with the spot in interspace 1 somewhat blurred on outer edge where it is deeply excavated making the whole like an arrow-head and it is much yellower than the rest, also there is a whitish diffused shade above it between it and the spot in interspace 2 which shade may sometimes be a mere dot; and there may even be a tiny extra subapical dot in interspace 9. Hindwing has the discal series of white dots, one in each interspace 2, 3, 5 and 6 nearly always present and, sometimes, even one in the cell. Besides, on the forewing upperside, the base of the wing out to half the cell and much further out along the inner margin below vein 1 is covered with ochreous scales (below costa) and decumbent, long, ochreous hairs and there is only a slight fringe of hair to inner margin. Hindwing the surface above the cell and over vein 6 is covered with some blackish, decumbent hairs; the rest of the surface with longish, ochreous ones thickest, as usual, all along vein 1*a*. Antennæ ochreous beneath; palpi below with an ochreous tint; abdomen below with no vestige of segmental bands; the legs ochreous.

Swinhoe has another species which he calls *Caltoris bevani* (M.), immediately following this in his book and he quotes Aitken and Davidson for the larva and pupa. De Nicéville says 'Recorded in the first Kanara paper, p. 370, n. 79 but omitted by Mr. Bell from the second paper. It is doubtless a wrong identification, the specimens referred to being *B. guttatus,* Bremer and Grey, n. 216 *ante,* though it may occur in Kanara, as Messrs. Elwes and Edwards record it from Bombay (l. c., p. 283). I have no specimens of *B. bevani* from any part of S. India. In Bombay Mr. Aitken says he has bred it on grass. It is doubtful if he knew the species when he wrote.' He did not, for the writer of these papers now knows he did not. De Nicéville's extract is taken from a paper on the foodplants of the butterflies of the Kanara District published by him in the *Journal of the Asiatic Society of Bengal,* vol. lxix, part ii, No. 2, 1900, pp. 187-278.

Larva.—The *shape* of the body is the same as that of most of the genus: circular in transverse section, thickest about the middle, fining down very little thence until about segment 3 forwards where segment 2 is much smaller, about the same breadth as the head, segment 3 is somewhat broader, segment 4 again broader, segment 5 about equal to the breadth at middle of body whence it decreases very gradually indeed backwards to cremastral or anal segment which is about as broad at its base as half the breadth at middle of body, is a parabolic curve in shape, somewhat longer than broad at base, convex transversely, sloping slightly dorsally, the end overreaching the claspers by about half the length of the segment; the prolegs and true legs all short, green; the head large compared to the neck but otherwise small for a skipper, the second segment without any raised or coloured collar; the *head* very little higher than it is broad across the base, triangular in shape, the face convex, the surface coarsely reticulate-rugose, somewhat shining; the true clypeus very long and narrow, nearly twice as long as broad at base, parallel-sided until near its apex, then acute-triangular, the whole half the length of face; the false clypeus a rather broad strip outside it, not as broad as half the breadth of true clypeus, forming an arch over the apex of this latter; the labrum rather shortly transverse, as long as one-third the height of true clypeus in length, colourless; the ligula narrower than labrum, nearly as long as broad, curved on the lateral edges, the front rather shallowly triangularly emarginate and set with bristles, colourless or slightly soiled round the edges; antennal basal joint colourless, the second joint soiled at tip; the mandibles large, their cutting edges entire, light-yellow in colour with the ends broadly black along the cutting edges; the eyes black, numbers 1-4 and 6 in a slight curve, 6 twice as far from 4 as 4 is from 3, the others equi-spaced, number 5 behind and nearest to 6 forming a triangle with 4 and 6; colour of head whitish with the whole of the cheeks from vertex to base at eyes black or the lower portion sometimes only suffused blackish leaving the middles of lower cheeks immaculate, a black line dorsally down middle of face from hinder margin over vertex to apex of clypeus, then down the false clypeus on each side of the true one, sometimes less, sometimes more far down, sometimes a suffusion of black in the middle of face outside these central dorsal markings and, in certain larvæ, again, the black may be replaced by brown-orange and, in some cases, black-orange may be the predominant colour; or the markings may be nearly obsolete. *Surface* of body is covered rather densely by a clothing of short, fine, erect, white, 0.05 mm.-long hairs, a fringe of these hairs 4× as long round the margin of the anal segment; the head also provided with these short hairs, becoming longer about mouth-opening; the segments well marked with the usual 6 or 7 parallel, transverse folds from hinder margin of each forwards. *Spiracles* small flush, oval, 0.15 mm. by 0.1 mm.; those of segments 2 and 12 at least three times as large; all whitish or light yellowish in colour. *Colour* light glaucous-green with a subdorsal, lateral and faint, spiracular, white line the whole length of body. L: 25 mm.; B: 4 mm. in the middle.

Pupa.—The pupa is like that of any other *Parnara* in *shape;* the body is circular in transverse section; the head-piece is absolutely parallel-sided with the front broad and produced out into a long snout which is in a line with the longitudinal axis of the body and broadly conical at the base, nearly cylindrical at the end, the outer half about as long as the dorsal visible portion of the vertex of head, this snout being a production of the lower vertex, the frons being beneath it and ventral; segment 2 is a narrow, parallel-sided, transverse band, its dorsal line in the same plane, at about 30° or less to the longitudinal axis of the pupa, as the head-vertex and the front slope of the thorax: it is about as long as the head-vertex without the snout; the thorax is feebly convex, hardly humped, its highest point or apex being just before its hinder margin which is a semicircular curve (perhaps nearer a short parabola) meeting the wings in a very widely open, largely rounded angle of about 60°; segment 4 is, in its dorsal line, equal to 5 in length, both being only half segment 6; segment 6 to segment 12 are coequal or very nearly so, in length; segment 13 is very short, only about one-quarter 12 and quite parallel-sided (i.e., the front margin parallel to hinder margin); segment 14 is half as long again as 12 and is longly triangular with the extremity broadly rounded (about half as broad as the segment at base), the margins thickened into ridges leaving the central dorsum hollow longitudinally, the whole segment very flattened and thin, the massed cremastral hooklets occupying a line at extremity ventrally across; the proboscis is extended free beyond the wings to segment 12 and even further, the antennæ reach half way, the midlegs three-quarters, the palpi are larger and there is nothing between the margins of legs and proboscis. *Surface* not shining, smooth, the segments well-marked, no clothing of any sort. Spiracles of segment 2 indicated by an opaque, oval, more or less subcutaneous, greenish body; the rest very small, oval, flush, whitish or greenish, difficult to see. *Colour* bright grass-green with distinct, white, longitudinal, subdorsal, fine and lateral, slightly broader lines the whole length of the body; there is also an indistinct, spiracular thread; the cremastral segment translucent-white. L: 20 mm. over all; 18 mm. without snout or cremaster; B: 4 mm.

Habits.—The eggs are laid single towards the tip of a blade of grass; the young larva emerging, makes a cell by drawing together the edges from the tip backwards with cross-silks; it eats the edges outside and clothes the inside with silk. As it grows larger it makes a more and more slovenly cell until, eventually, when full grown, it lives practically open on the undersides of leaves. It pupates on the underside of a blade of grass spinning two cross-threads to draw the edges loosely together and is attached by the tail and a body-band; the larva emits a cereous excretion from the sides of the abdomen on segments 11, 12 and the pupa is sometimes lightly covered with this. The butterfly frequents grasslands, rice-fields, jungles in all sorts of country and flies low down amongst the herbage; it flies well and strongly, feeds greedily at low flowers and basks on the uppersides of leaves or on the ground with its wings half opened, the lower often depressed below the plane of the upper. It rests with the wings tightly closed over the back on the ground very often, on twigs, leaves, etc. Swinhoe gives the habitat as 'Sikkim, Assam, S. India, Burma, Ceylon, Andamans, China, Malay Peninsula and Archipelago.' It is common in Kanara, Belgaum, Poona and frequents the plains as well as the hills, the rainfall seeming immaterial. The larva feeds upon soft grass of all sorts and rice but never on bamboo.

Sub-genus—*Chapra*.

Imago.—As in the sub-genus *Baoris* or *Caltoris* in colour, markings and general facies; but are insects that fly close to the ground and live amongst the herbage; rest on the ground generally with the wings closed over the back, fly only for short intervals but quickly, powerfully and are more or less fond of sunlight and open places.

Antennæ.—With the club short and stout, the terminal crook short, as long as, or slightly longer than the width of the club.

Palpi.—As for genus.

Forewing.—With a linear, discal stigma in the male from the basal third of vein 2 to a little beyond the middle of vein 1 in a straight line, inwardly oblique. Venation exactly as in genus.

Hindwing.—As for genus.

Egg.—As for genus.

Larva.—As for genus, but with the head more triangular in shape and with, generally, a stripe of red, brown or black separating the face from cheeks.

Pupa.—Exactly as for the genus.

Habits.—As for genus except that the larvæ all feed upon grass instead of, sometimes, bamboo. Further see under '*imago*' above.

228. **Chapra mathias** (F.).—Male. *Upperside*: dark olive-brown, somewhat glossy. 'Forewing with eight semidiaphanous, whitish spots; two small ones at the end of cell one above the other and well-separated from each other; three subapical minute dots of equal size in an outwardly-oblique curve; and three discal spots in a continuous series with the subapical more or less, the uppermost discal spot minute like the subapical ones, the next somewhat large, the third largest of all in interspace 2, their outer sides somewhat produced; all these spots vary much in size in different examples, sometimes all are minute and indistinct; the sex-streak is whitish. Hindwing usually without markings but there are, rather rarely, two indistinct, pale, discal spots. *Underside* paler. Forewing blackish on the basal half between the veins 1 and 2; the spots as on the upperside. Hindwing with a white dot in the cell near its upper end and a discal series of four white dots, one in each of the interspaces 2, 3, 4, 5. Antennæ black with white dots on the underside of the shaft, the club white beneath; palpi with grey and white hairs above, white beneath; head and body concolorous with the wings; beneath the pectus and abdomen are white and there are some hairs on the thorax; legs pale brownish-ochreous.—Female. Like the male, the spots all larger and an extra spot on vein 1 in continuation of the discal series. Expanse 35 mm. to 40 mm.' (Swinhoe in *Lepidoptera Indica*, vol. x, pp. 321, 322).

The *upperside* forewing in the male has ochreous scales above vein 12 on the costa and upper half of cell; ochreous hairs at base of interspace 1 as far out as the discal stigma and similar decumbent, longish, ochreous hairs between vein 1 and inner margin nearly out to outer margin with a slight fringe only along the inner margin. Hindwing has the whole wing including cell and the part below it covered by longish, decumbent, ochreous hairs from base to three-quarters way out to outer margin, specially dense in interspace *1a;* the portion above below costa down to top of cell and vein 6 with shorter, decumbent, brown hairs more sparsely. *Underside* hindwing may have a dot in interspaces *1b,* 2 to 7, one in each as well as in cell, those in *1b,* 5 smallest as a rule and the first to be absent, those in 2, 4 largest as a rule.—Female invariably lighter in colour and with, on the forewing, not only a spot more than the male on the upper edge of vein 1 but also, very frequently a dot-spot just under the largest discal one in the top of interspace 1 but also a further dot-spot in interspace 5, the furthest out of any. Antennæ with the underside of club only whitish on the basal half, the tip of it red-brown.

Swinhoe quotes Forsayeth for the larva and pupa as under :—

Larva.—Found on long, coarse, green meadow grass; head triangular, on a neck; a brown line on margin of head. Body grass-green with light-yellow bars across back; a whitish line along either side above origin of legs.

Pupa.—September 3rd : Two larvæ have become pupæ; they lie alongside a blade of grass attached by a band across thorax, and also at tail; head generally points upwards; body of a translucent-green colour, quite naked and unenclosed in any covering of any description. September 13th : both pupæ have become imagoes to-day; they are a species of Hesperidæ very common about here, flying briskly by day and settling on leaves of trees at dusk. October 9th : another imago to-day, same history as above.

Swinhoe further gives the distribution as India, Ceylon, Burma, China, Japan, Malay Peninsula and Archipelago; adding that it is 'A very common species with a very wide range; our figures of the larva and pupa are from W. Elliot's original drawings, bred in Madras.' These figures are depicted upon plate 831 in *Lepidoptera Indica,* 3 the male, *3a* the female, *3b* the underside and *3c* the larva and pupa.

229. **Baoris (Chapra) subochracea,** (M.).—'*Upperside* brown tinted with ochreous. Forewing with eight semidiaphanous spots disposed as in *C. mathias,* but all larger, the two cell spots placed obliquely, the lower one shifted a little inwards whereas in *mathias* they are erectly placed one above the other; in *mathias* they are always small, in this species they are much larger, prominent and distinct. Hindwing: with three small, discal spots, the upper one the largest. *Cilia* ochreous-brown on the upper half of forewing becoming white hindwards; on the hindwing with an ochreous-brown base. *Underside* paler and more strongly tinted with ochreous. Forewing with the middle space from the base outwards to one-third before outer margin blackish; spots as on upperside with a somewhat diffused, additional, white spot attached to the upper end of the spot in interspace 1. Hindwing with a prominent, round, white spot in the cell near its end; the discal series prominent, the upper spot large and round. Antennæ black, spotted with white below, the club on the underside white; palpi above with grey and white hairs, greyish below; head and body concolorous with wings; on the underside the pectus and abdomen are greyish-white, the thorax with grey hairs; legs ochreous-brown.—Female like the male; but, on the upperside of the forewing, there is an additional spot in the discal series on vein 1 and two additional dots, one immediately below the outer side of the spot in interspace 2, the other below the subapical dots but a little outside of them; on the underside the two lowest spots are pure white; the spots on the hindwing are larger and there is sometimes an extra dot on the underside; but one or more of them are absent in some examples. Expanse 37 mm. to 42 mm.' (Swinhoe in *Lepidoptera Indica,* vol. x, p. 322. There are figures also of the butterfly and larva and pupa on plate 832, figure 2 male, *2a* female, *2b* underside, *2c* larva and pupa).

De Nicéville, over twenty years ago, published an article in the *Journal, Asiatic Society of Bengal,* vol. lxix, Part II, 1900, pp. 187-278 which he called 'The Foodplants of the Butterflies of the Kanara District of the Bombay Presidency with a Revision of the species of Butterflies there occurring, in which he states under No. 241 *Baoris* (*Chapra*) *subochracea,* Moore, on p. 276 that 'Mr. Bell thinks that this species and the following' (which is 242 *Baoris* (*Chapra*) *mathias*) 'are one and the same, in which I am inclined to follow him as I have never been able to separate them satisfactorily. The form with the underside grey, typical of *subochracea,* is never found in Kanara in the rains and is probably a dry-season form of *B. mathias.* Messrs. Elwes and Edwards (l.c., p. 275) keep them distinct. They say that the form of the male genitalia is different in the two species.' The genetalia pictured *are* certainly very different.

Egg.—In *shape* it is a dome. *Surface* shining and, under a powerful lens, obscurely, minutely, hexagonally reticulate and, at the extreme base, there are distinct indications of the beginnings of very faint, meridional ridges, many of them; the micropyle on the apex is extremely small and hardly perceptible. *Colour* when fresh is very light-green, soon changing to dull bone-colour. B: 0.75 mm.; H: 0.5 mm.

Larva.—The body is of the *shape* characteristic of the genus *Parnara*: circular in transverse section, thickest about segment 5 and someway backwards, thinning rather suddenly in 4, 3, 2 to head and much more gradually backwards to anal segment, the ventrum somewhat flattened, especially when the larva is sitting with the front segments somewhat contracted, the head laid back on segment 2, in which position the legs and prolegs are hardly visible; segments 2 and 13 are, as usual, very short; the anal segment is rather long, flattened, overhanging the anal claspers by a good deal, broadly rounded at end where it is fringed with comparatively long, porrect, fine, white hairs; the *head* is triangular in shape, a good deal longer than it is broad across the base where the mouth-opening is, the vertex narrowly indented in dorsal line with a small, triangular emargination; colour lightish-green, the false clypeus as well as true clypeus both outlined thinly brown very often, a nearly 1 mm.-broad brownish-red band from eyes, just including front eyes, between face and cheeks to vertex of each lobe, sometimes thinly joined across vertex well in front of hinder margin, this band flanked thinly by white in front and more obscurely behind; the surface coarsely reticulate-rugose and set with minute, semi-decumbent, fine, white 0.05 mm.-long hairs, these hairs longer about mouth-opening, the surface slightly shining; the true clypeus nearly half the length of face, acutely triangular, twice as high as it is broad at base, the sides very slightly waved or bent inwards about middle; the false clypeus less than half its width, a broad outwardly-convex band on each side, arching over apex and with its own apex also acute; the labrum transverse, rusty-suffused, under one-third the true clypeus in length, hinder margin straight, front margin slightly curved; the ligula rather shorter than labrum, kidney-shaped, the sinus very shallow, rounded, the outer rather acute and fringed with hair, colourless-shining; the antennal, basal joint green, the second rusty; the mandibles large, the cutting edges entire, their colour yellowish with the ends broadly red-brown; the eyes black, arranged in a curve as regards the top four which are equally spaced, an eye-diameter apart, the 6th in a line with 3 and 4, three times as far from 4 as 4 is from 3, the 5th behind forming an equilateral triangle with 4 and 6. *Surface* dull, covered with minute, white, fine, erect hairs all over of 0.05 mm. in length, those on the free margin of anal segment 4× as long and each segment folded transversely from hinder margin forwards in 6 or 7 parallel, superficial folds. *Spiracles* small, oval, flush, very light yellow in colour, those of segments 12 and 2 larger. *Colour* is yellow, segment 2 pure green; all but segment 2 covered densely with dark-green, rounded dots arranged more or less in transverse rows; the folded parts of anterior segments especially yellow-looking; a dark-green, dorsal line, a lateral, thin and a spiracular, broad, white line or band; ventrum watery blue-green. L: 30 mm.; B: 4 mm.

Pupa.—This pupa is identical with that of *Baoris colaca* in *shape* with the proboscis similarly produced free to segment 12 beyond the wings, the antennæ reaching half-way towards ends of wings the midlegs three-quarters the way; the head-piece exactly similar, the snout bearing the same proportion to head-vertex as in that species, the segment 2 the same; the thorax and planes of dorsal lines of the three segments similar, segment 13 very short, the cremaster long, similarly shaped, down-curved; segments 4, 5 in dorsal line coequal, segments 6 and following segments 2× their length; the hinder margin of thorax, however, meets the wings in an angle of 45°, this angle similarly widely rounded. *Surface* similar. *Spiracles* also similar. *Colour* lighter green with the same subdorsal and lateral, white, longitudinal lines, here, however, reaching no further forwards than the hinder margin of thorax. L: 25 mm. over all; over 21 mm. without cremaster or snout; B: 4.5 mm. The thorax is, perhaps, slightly stouter than in the pupa of *Parnara colaca.*

Habits.—Similar to those of *Baoris colaca* but the larva starts in a cell made of the point of the leaf turned right over and back onto the upper surface of blade, the two edges on each side being joined together--the blade is transversely folded back that is instead of longitudinally manufactured into a small tube. Later on the larva lives on the undersides of the blades, often without any cell; it pupates on the underside free, the edges of the blade loosely drawn together with a cross-thread fore and aft, the bottom of this open cell covered with a cereous excretion, the pupa fixed by the tail and a body-band. The insect is a strong, fast flier, frequenting grass-lands and jungles all over India; does not fly high; often lights on the ground and basks there and on leaves with its wings half open, the hindwing depressed below the upper; at rest it sits with them joined over the back in some sheltered position. Swinhoe gives the habitat as India. He also figures the butterflies, larva and pupa on Plate 832 of *Lepidoptera Indica,* figures 2 male, 2*a* female, 2*b* undersides, 2*c* the larva and pupa—none of them good representations of nature.

Sub-genus—*Parnara.*

Imago.—These are marked in nearly exactly the same manner above and and below except that the actual colour of the undersides is here nearly always bright-ochreous compared to most other species of the genus *Baoris.* They all sit for preference on the ground, bare or otherwise and rarely on leaves; they frequent all sorts of country; they are rapid fliers.

Antennæ.—Very short, less than half the costa of forewing, even shorter than it is in *Chapra* and with the club very stout and the apiculus or crook very small, never as long as the width of the club.

Palpi, hind tibiæ.—As for the genus.

Forewing, hindwing.—As for the genus.

Egg.—Also as for the genus.

Larva.—See below under *Parnara bada.* It has a round head recalling those of the genus *Telicota.*

Pupa.—See below also. It is not anything like the other members of the genus *Baoris.*

Habits.—Here again the habits of the larva in making the cell as well as the fact of the pupa being tightly enclosed instead of more or less naked and open is quite different from others of the genus *Baoris.*

230. Baoris (Parnara) bada (M.).—Male. *Upperside* dark-brown with 'an ochreous tint. Forewing with the basal half of the interspaces with dull ochreous, hair-like setæ; with eight semidiaphanous, ochreous-white spots of moderate size, two in the cell, well within its end, well-separated, one above the other; the others in a continuous series, commencing with three subapical spots in interspaces 6, 7, 8 in a straight line, the uppermost one often absent; a small similar-sized discal spot immediately below them in interspace 4; a larger discal spot in interspace 3 with a much larger and somewhat quadrate spot in interspace 2; all three of these discal spots in an inwardly-oblique line. Hindwing with all but the outer portion of the wing covered with dull-ochreous hairs with four spots in a very oblique line on the disc, one in each interspaces 4 and 5 (vein 5 is wanting) and 2, 3 (sometimes also in 6). *Cilia* of both wings rather bright ochreous-white with a brown base. *Underside* paler with an ochreous-pinkish tint, all the veins of both wings, all but the inner portion of the forewing and the entire surface of the hindwing covered with dull ochreous scales; the spots as on the upperside, the spots on the hindwing somewhat larger than they are on the upperside (with an extra white spot at extreme-lower end of cell and sometimes one in the very middle of interspace 7 as well); the spots on the hindwing somewhat larger than they are on the upperside, somewhat quadrate in shape and edged with blackish (more brownish and not always the case). Antennæ black, minutely dotted with white on the underside, the club smeared with white on the underside and dull-red at the tip; palpi, head and body concolorous with wings; on the underside the palpi and pectus with ochreous-white hairs and some similar but duller-coloured hairs on the thorax and abdomen.—Female paler than the male, on the underside usually very much paler; markings similar, all the spots much larger (not really very much), somewhat suffused; a small additional spot against vein 1 of the forewing; the discal spots on the hindwing larger, somewhat elongate and very prominent; on the underside there is a small spot in the cell near its end.'

The above is Swinhoe's description of *Parnara guttata* (Bremer and Grey); with the exception that what is added in brackets is taken from a series of bred specimens of *Baoris* (*Parnara*) *bada,* (M.), all from the N. Kanara District. He then next describes this latter species by comparison with *guttata* (*Lepidoptera Indica,* vol. x, p. 329), differentiating it by saying it is smaller, its upperside being dark-brown without the ochreous tint while all the Kanara specimens have got it when not absolutely new (they are, of course, much darker when freshly bred as are all other butterflies); he says that the hairs covering the hindwing are as in *guttata* but grey in colour and not dull-ochreous as in that species while in the Kanara butterflies they *are* ochreous, at any rate in the rains. He further says that, in the forewing upperside there are only two subapical spots 'the uppermost being absent, the two subapical quite minute, being mere dots; the other three discal spots increasing in size hindwards, all three quite small and there are no cell-spots'. Now, in Kanara—and there was never any question as to the species existing there being typical *bada*—there are very often three subapical spots and not absolutely minute either, the discal spots are of quite a respectable size and not at all 'quite small'. He goes on to say that, in the hindwing, *bada* has three dots on the disc in an outward curve in interspaces 2, 3 and 4 while the Kanara series often show them in 2, 3, 4, 5 and even an indication in 6 on the upperside—on the underside there is one in 7 as well occasionally and nearly always one in the end of the cell. The only real difference that there is appears to be in the female and it consists in the absence totally of the spot 'against the submedial vein in continuation of the discal series so prominent in *guttata'* although, as he says, it is sometimes 'only very slightly indicated' by an obscure paleness. In *bada* in N. Kanara there is always a green glint, somewhat metallic, on the thorax and top of the head.

It will be noticed that in the description of *bada* (though not actually in words, yet in comparison with *guttata*) Swinhoe leads to the conclusion that there is no cell-spot on the underside of the hindwing in the male. In Kanara specimens there is often such a cell-spot, in fact generally, in both sexes, practically always in the female. He says that *guttata* on the underside has an 'ochreous pinkish tint'. The Kanara *bada* never has a pinkish tint but is always a bright greenish-ochreous, the green very slight indeed. Most of the specimens were bred in the rains and are a good deal brighter underneath than insects caught in the cold weather and dry season which are duller and lighter—as is the case with practically all butterflies.

Elwes and Edwards in 'A Revision of the Oriental Hesperiidæ' in the *Transactions of the Zoological Society,* 1897, vol. xiv, Part IV, pp. 101-324, consider that *Baoris guttata* and *bada* are one insect. Swinhoe considers they are two species, saying 'de Nicéville says that, in his opinion (*Journ. As. Soc., Bengal,* 1895, p. 550), it is quite distinct from *guttata* and we have come to the same conclusion'; meaning by 'it' the form or species *bada* now under consideration. He, therefore, as in duty bound, confines *guttata* to N. W. Himalayas, Sikkim, Assam, China, Japan and Korea saying that it does not appear to occur anywhere in Southern India or Ceylon.

Egg.—This is higher than half the breadth, the *shape* of a dome based on a very narrow, 0.02 mm.-wide, transparent, shelving, ring or band for pedastal or foundation. *Surface* shining, quite smooth except for some minute pits that are very superficial and irregularly disposed over the surface, never more than 0.5 mm. apart from each other and there are very obscure indications of meridional ribs 0.05 mm. a part all along the foundation-band but nowhere else; the micropyle is a small pit at apex. *Colour* pearly-white when extruded but becoming duller whitish afterwards. B: from 0.9 mm. to 1 mm.; B: 0.5 mm. to 0.6 mm.

Larva.—The *shape* of the body is subcylindrical, the ventrum flattened, somewhat swollen-looking about the spiracles of segment 12, making that segment appear a slight bit broader than 11; segments 13, 14 becoming suddenly narrower than 12 at the front margin of 13, with 13 itself extremely short, 14 rounded semicircularly behind with a dorsal slope of about 30° in which 13 participates; the body is thickest about segment 8, being highest there; there is a distinct neck; the *head* rounded or long-semicircular in shape with parallel sides and broadly-rounded vertex, very slightly bilobed, the dorsal line depressed slightly as far as apex of clypeus; the surface of the head cellular-rugose, shining somewhat, haired minutely under the lens and it is a greenish yellow-brown in colour with a black-brown stripe separating the cheek from the face of variable width and a dorsal band of the same colour from vertex down to the apex of the clypeus splitting down each side of it and also with another line of the same colour on each lobe parallel to the dorsal line, starting from the middle of each side of true clypeus to run up to somewhere about the level of the false clypeus (middle of face); there is a thinnish, black collar reaching from spiracles to spiracle just behind the middle of segment 2 and the segment is more or less chitinized dorsally; the hinder margin of the head itself is always dark blackish-brown. *Surface* of the body covered with minute tubercles, each bearing an equally minute, erect hair longest round the anal margin and also longer along the dorsoventral line of body although there not as long as on segment 14 margin; all segments well expressed. *Spiracles* slightly-raised and somewhat conspicuous, oval and light-brown in colour, those of segments 2, 12 larger than the rest. *Colour* of body greyish-green slightly yellowish on the segment-margins. L: 33 mm.; B: 5 to 6 mm.

Pupa.—This is of the *shape* of the pupæ of *Telicota* and quite unlike the other *Baoris* species; the *head* is square in front, the eyes not prominent; segment 2 is short, it and head being parallel-sided, slightly transversely convex, sloping slightly up to thorax; the thorax is stout, very little humped, very little wider than segment 2; there is very little dorsal constriction at 5; shoulders evenly rounded; the body is circular in transverse section from shoulders to segment 11, decreasing very little in width; after 11 it narrows rapidly to end, conewise, the cremaster pointed-triangular, forming the apex or end; the proboscis outreaches the ends of wings but is only produced free as far as the middle of segment 10. *Surface* of body is covered all over with a white, cereous, excreted powder and therefore is difficult to see but is no doubt covered with short, erect hairs. *Spiracles* of segment 2* * *; the rest oval, brown, inconspicuous. *Colour* of pupa a watery, very light yellowish-green for head, thorax and wings; a dirty whitish-yellow for abdomen. L: 20 mm.; B: 4.75 mm.; H: 4.75 mm.

Habits.—The egg is laid on the underside of leaves or blades of rice or grasses. The larva makes a cell out of blades of grass joined together with silks, making a firm, tight house from which it comes forth to feed. When about to pupate it makes this house very srong and lines the whole of the inside plentifully with silken carpet, excreting also much white powder. Both the ends are closed so that no moisture can get in. The caterpillars are generally to be found in numbers in the monsoon months in the rice-fields where the imago is also always plentiful. This butterfly rests much on the surface of the ground and frequents paths, roadsides and open spaces everywhere in the jungle and right out in the plains, in hilly country whether dry or subject to the heaviest rainfall. It inhabits, according to Col. Swinhoe, India, Ceylon, Burma, Formosa, Malay Peninsula and Archipelago and Hongkong. He says 'The types are from Ceylon, it is a common species, recorded from many parts of Southern India, Ceylon and Burma; it does not appear to occur anywhere very far north; we have it from Belgaum in S. India, we took it at Bombay and have it from Rangoon and many other localities; Watson records it from the Chin Hills; Davidson, Bell and Aitken from Karwar where they bred it; Elwes from Perak, Java, Borneo; Butler from Formosa; J. J. Walker from Hongkong; de Nicéville from Calcutta, Cachar and Sumatra; de Nicéville says that, in his opinion, it is quite distinct from *P. guttata* and we have come to the same conclusion; all Plœtz's types came from Java.'

The conclusion that is to be drawn from all the above is that there is but one somewhat variable species of this *Baoris*. Swinhoe apparently considers there are four: *guttata, bada, vaika* and *flexilis*. *B. vaika* is a synonym of de Nicéville's *philotas* which is nearly certain to be an underbred *bada*. *Flexilis* (Swinh.), is surely not a tenable species.

The next species *Baoris* (*Caltoris*) *canaraica* (M.), put under the sub-genus *Parnara* (Swinhoe treats these sub-genera as full families) by Swinhoe, is, by antennæ and habits, actually a *Caltoris* as characterized by himself. He probably had specimens without antennæ and made the mistake that way. From specimens both bred and captured in Kanara the insect is certainly a *Caltoris*.

231. Baoris (Caltoris) canaraica (M.).—Male. *Upperside* 'dark olive-brown. Forewing with ochreous-grey setae on the basal half of the costal space and some ochreous-grey hairs at the base of the wing below the cell; eight moderate-sized, semidiaphanous spots: two in the cell towards the end, well-separated, placed obliquely one above the other; the others in a continuous series, three uppermost subapical in an outwardly-oblique curve, three discal in an inwardly-oblique line, increasing in size hindwards, in interspaces 4, 3, 2, the last somewhat outwardly produced. Hindwing without markings, all but the outer margin covered with ochreous-grey hairs. *Cilia* brown, the tips becoming whitish towards the hinder margin of forewing and throughout the hindwing. *Underside* slightly paler than the upperside. Forewing with the hinder-marginal space before vein 2 paler caused by minute, greyish-white scales; the spots as above with an additional, indistinct, whitish spot on vein 1 in continuation of the discal series. Hindwing with the costa narrowly, the abdominal fold and a broad discal band of minute, whitish scales. Antennæ black with white spots on the underside of the shaft, the club smeared with white, the tip tinted with red; palpi, head and body concolorous with the wings, with ochreous-grey hairs; on the underside the palpi, pectus and abdomen with ochreous-white and blackish hairs and some similar hairs on thorax; legs brown above, ochreous-grey beneath.—Female like the male but on the upperside there is an additional white spot to the discal series of the forewing, situated on vein 1 about the size of the spot in interspace 3; and on the underside of the hindwing there are three minute, white, discal dots in interspaces 2, 3, 6. Expanse 35 mm. to 42 mm.'

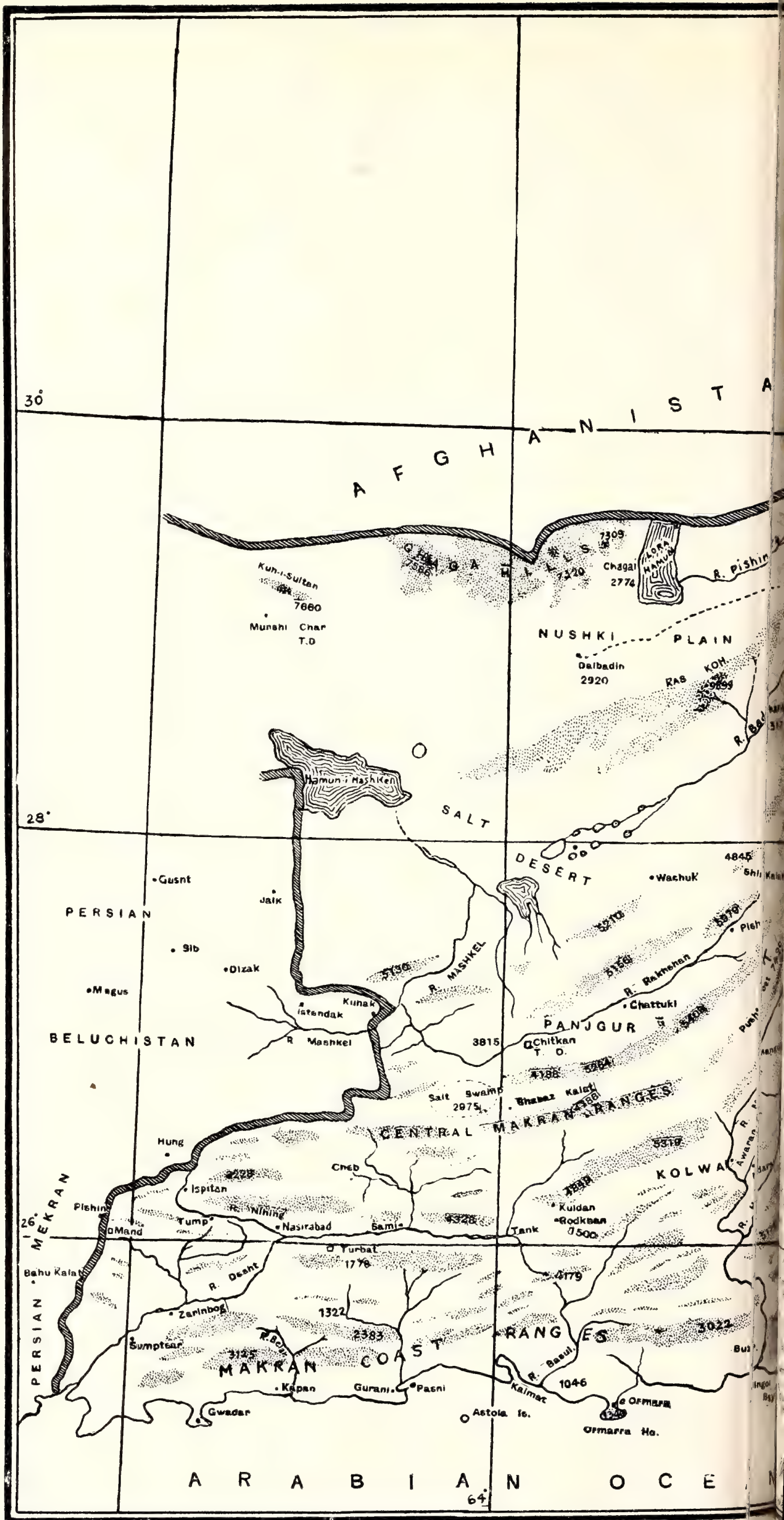
The above is written by Swinhoe in *Lepidoptera Indica,* vol. x, pp. 326, 327. Since it was published, the butterfly has been reared and quite a respectable series has been got together in its habitat given as 'Kanara, South India' by Swinhoe. It apparently has never been obtained anywhere else.

Larva.—This is of exactly the same type and *shape* as that of *Baoris kumara* or any of the others, the anal segment broadly rounded, overreaching the short anal claspers; the prolegs and true legs also short, especially the former and green of a light colour like the ventrum; the *head* semielliptical in shape with the vertex somewhat narrowly rounded compared to the other *Caltoris* species (*Kumara seriata*), the surface moderately shining and rather roughly cellular-rugose, covered with tiny, erect hairs with the main hairs about double the length, some about the mouth-opening at most four times the length of the shortest which would be about one-quarter the basal width of the clypeus, the antennal hair rather longer still; the colour very pale-yellow with a dark-brown band containing the uppermost four eyes and a brownish smudge in the middle of the clypeus, against its base and running up half way followed by a dorsal line to its apex that is still more obscure; this true clypeus long-triangular in shape, the apex acute, the colour of the head, reaching about half the length of head (the head is about 3.5 mm. broad by the same in height), that is to say 1.4 mm. long by 1 mm. wide (in the estimated height of the head the prominent mandibles are included and they add some 0.4 mm.); the false clypeus is a narrow strip outside the true one of slightly over 0.1 mm. in breadth arching somewhat widely over the apex of the true clypeus and reaching rather more than 0.2 mm. further up, this apex acute; the labrum is a transverse piece as broad as the clypeus (1 mm.) and about 0.2 mm. long; the ligula a circular, quite transparent piece about as long as twice the length of labrum by slightly more than that in breadth with a small sinus; antennal basal joint the same colour as the ventrum more or less with the second joint light-rusty; mandibles large, 0.6 mm. wide, light-rusty with broadly dark rusty-brown, regular ends, the cutting-edges quite entire; the eyes 0.1 mm. in diameter, numbers 1, 2 hardly half an eye-diameter apart, 2 just over 0.15 mm. from 3 which is also the distance between 3 and 4, number 6 = 0.35 mm. from 4, and 5 behind 4, 6 removed from number 6 a distance of 0.2 mm. and about the same from 4, all arranged with 1 to 4 in a slight curve, number 6 in a straight line with 3, 4 with 5 making the apex of a triangle behind 4, 6. *Surface* of body dull, smooth to the eye but covered with minute, erect, light hairs 0.05 mm. long and with somewhat thickened tips, those round the free margin of segment 14 are 0.15 mm. long; the segments are all distinct and have the usual impressed six lines parallel to the hinder margin, the last somewhere near the middle of the segment. *Spiracles* oval, flush, yellowish, those of 12 and 2 larger. *Colour* bluish-white like that of *Baoris kumara* or *farri*. L : 44 mm. ; B : about 6 mm.

Pupa.—Exactly the same *shape* as that of *Baoris kumara,* with the identical-same cremaster and snout to the head but shorter than in that species ; the relative lengths of the segments are the same too and 13 is about one-third of 12, segment 14 (cremaster) being somewhat longer than 12 with the same dorsally hollowed-out cremaster ; the *head* has the clypeus similarly triangular or hexagonal, the ligula similarly diamond-shaped but rather large ; the forelegs reach about half the length of wings, the midlegs three-quarters, the antennæ ending between the two, the proboscis, however, is not so long as in *kumara* and ends at the hinder margin of segment 10. *Surface* of body with the same minute 0.05 mm. long, erect hairs ; the abdominal surface being slightly transverse-wrinkled also, the segments quite distinctly marked. *Spiracles* of segment 2 similar pale-yellowish ovals about as long as the adjacent antenna, is broad, flat ; the rest are about one-eighth of a segment-length long by rather less than half that broad and are flush, rather pointed-oval, light yellowish-white in colour. *Colour* as in *kumara*. L : 30 mm. ; B : 5 mm.

Habits.—More or less the same as for the others, *farri, kumara* and *seriata* as to oviposition, places chosen for such and habits of making the larval cell. Imagines were obtained in the N. Kanara District of the Bombay Presidency in the year 1895 some forty miles inland from the coast in the heavy jungles of the Western Ghats by the writer and the larva was discovered shortly afterwards in the same locality. The species was first captured in the same District by a Revenue Officer of the name of Ward who lived there sometime in the middle of last century and had not been heard of again afterwards until 1895. It is not really a very rare insect, having been seen fairly frequently in places frequented by *kumara* and *seriata*. Quite recently specimens have been bred at Karwar itself on the actual coast from larvæ obtained only a few miles inland; but the localities they came from are very wet in the monsoon. The larva feeds on Bamboos generally, of any species. No specimens of this species have ever been obtained anywhere but in Kanara.

(*To be continued.*)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AFGHANISTA
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Chagai
2774
LORA HAMUN
R. Pishin
Kuh-i-Sultan
7660
Munshi Char
T.D
NUSHKI PLAIN
Dalbadin
2920
RAS KOH
R. Bad
Hamun-i-Mashkel
SALT DESERT
Gusht
Jaik
PERSIAN
BELUCHISTAN
Sib
Dizak
Magus
Kunak
Isfandak
R. Mashkel
5136
R. MASHKEL
Washuk
4845
5210
5156
5870
R. Rakhshan
Chattuki
PANJGUR
3815
Chitkan
T.O.
4186
Salt Swamp
2975
Shahaz Kalat
CENTRAL MAKRAN RANGES
5310
KOLWA
R. Awaran
Hung
Ispitan
R. Nihing
Cheb
Pishin
Mand
Tump
Nasirabad
Sami
4326
Tank
Kuldan
Rodkban
1500
Turbat
1776
PERSIAN MEKRAN
Bahu Kalat
R. Dasht
Zarinbog
1322
2383
Sumptear
3125
MAKRAN COAST RANGES
4179
R. Basul
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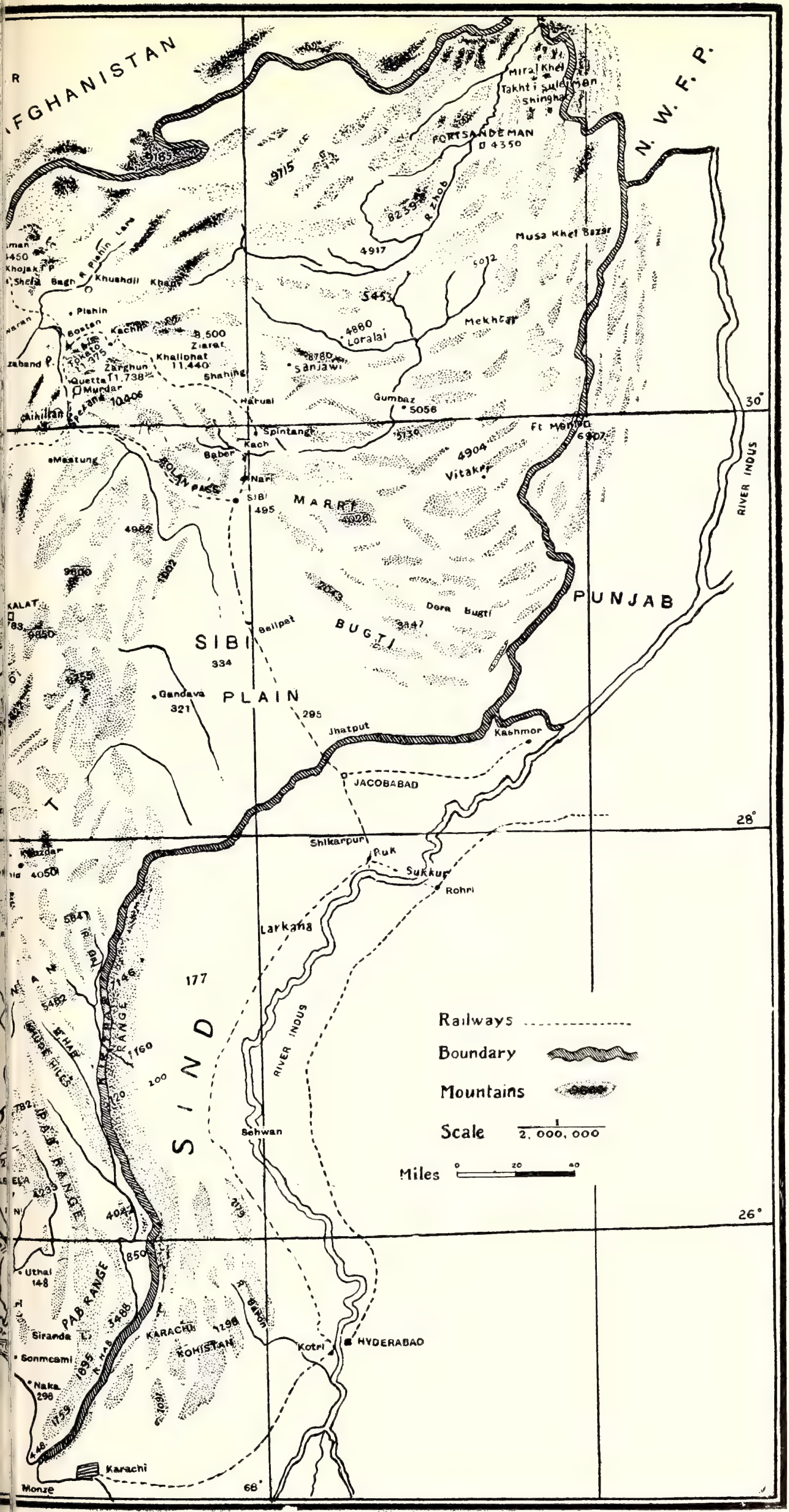
Kapan
Gurani
Pasni
Kalmat
1046
Ormara
Astola Is.
Ormara Hd.
Gwadar
ARABIAN OCE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Takht i Suleman
Shingha
FORT SANDEMAN
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Musa Khel Bazar
5012
5453
Mekhtar
4880
Loralai
8780
Sanjawi
Khojak P.
Shela Bagh
R. Pishin Lora
Khushdil Khan
Pishin
Bostan
Kach
8,500
Ziarat
Khalifat
11,440
Takatu
11,375
Zarghun
11,738
Quetta
Murdar
10,406
Shahing
Harnai
Gumbaz
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5130
Spintangi
Kach
Ft Munro
6307
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Baber
Nari
Mastung
BOLAN PASS
SIBI
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MARRI
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4904
Vitakri
RIVER INDUS
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KALAT
9850
Bellpat
Dera Bugti
BUGTI
3847
PUNJAB
SIBI
334
PLAIN
Gandava
321
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Jhatput
Kashmor
JACOBABAD
28°
Shikarpur
Ruk
Sukkur
Rohri
Khuzdar
4050
Larkana
5847
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KIRTHAR RANGE
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RIVER INDUS
SIND
Sehwan
PAB RANGE
LAKHI HILLS
4042
26°
850
Uthal
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Siranda L.
Sonmiani
Naka
298
R. Hab
KARACHI
KOHISTAN
1298
R. Baran
Kotri
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Railways
Boundary
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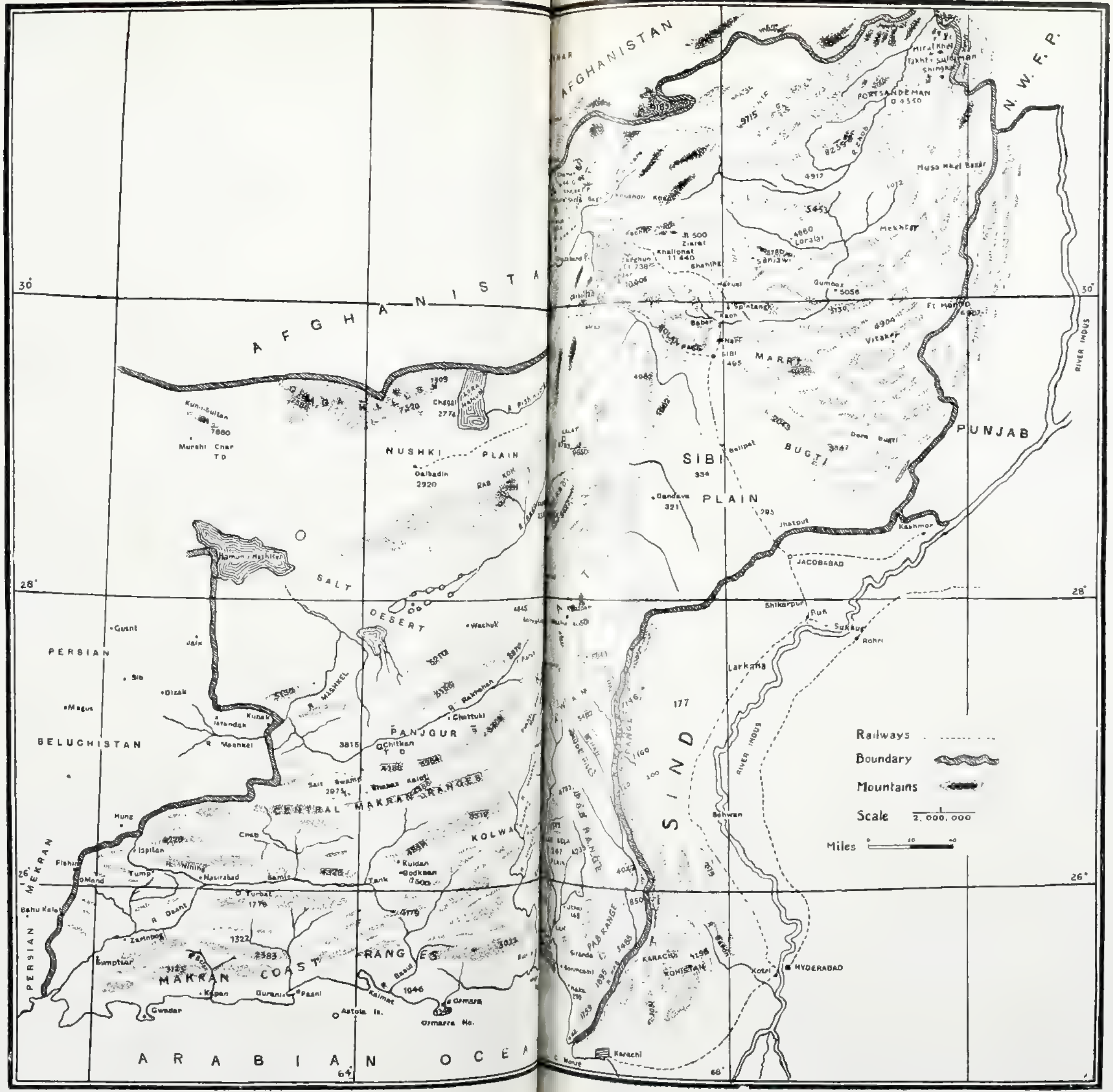

AFGHANISTAN
A F G H A N I S T A N
N. W. F. P.
PUNJAB
SIND
PERSIAN
BELUCHISTAN
PERSIAN MEKRAN
ARABIAN OCEAN
SIBI PLAIN
NUSHKI PLAIN
SALT DESERT
MARRI
BUGTI
PANJGUR
KOLWA
CENTRAL MAKRAN RANGES
MAKRAN COAST RANGES
PAB RANGE
KIRTHAR RANGE
KOHISTAN
RIVER INDUS
Hamun-i-Mashkel
Kuh-i-Sultan
Chagai
Dalbadin
Fortsandeman
Musa Khel Bazar
Loralai
Ziarat
Sibi
Jacobabad
Shikarpur
Sukkur
Rohri
Larkana
Kashmor
Sehwan
Kotri
Hyderabad
Karachi
C. Monze
Gwadar
Pasni
Ormara
Astola Is.
Turbat
Tump
Mand
Kalmat
Kapan
Washuk
Chitkan
Nasirabad
Ft Munro
Gandava
Bahu Kalat
Jiwnri
Railways
Boundary
Mountains
Scale 1/2,000,000
Miles
30°
28°
26°
64°
68°

THE BIRDS OF BRITISH BALUCHISTAN

BY

CLAUD B. TICEHURST, M.A., M.R.C.S., M.B.O.U., F.R.G.S.

PART I

(*With 2 Plates and a Map*)

PROLOGUE

Whilst I was stationed at Karachi and working in my spare time at the 'Birds of Sind' I naturally had to take into consideration, for a proper understanding of the avifauna of that province, the avifauna of Baluchistan. I found what had been recorded for that Agency was very scattered in the literature and mostly dealt with the Quetta District. During my time in Karachi, Mr. Kinnear asked me to work out for our Society a very interesting and valuable collection made by Mr. J. E. B. Hotson during his political travels in Mekran and Kalat. This I was very glad to do and at Mr. Kinnear's suggestion I have as well brought up to date everything which has been recorded about the avifauna of British Baluchistan and embodied it in this paper. My own personal experience of Baluchistan is but small and consists of a visit to Ziarat in September and October 1919, two short visits to Quetta and three visits to the Habb Valley or the Sind—Las Belas Frontier and therefore this paper is very largely a compilation, for which I make no excuse as, since no complete ornithological survey has ever been made of the Agency as a whole, the bringing together in one paper of all known facts will be of great value and help to would-be workers in the future.

INTRODUCTION

British Baluchistan is not of course a zoogeographical entity and few political areas can contain within their boundaries such diverse kinds of country—flat desert plain, thickly wooded mountains, cultivated valleys, bare hills—while the mangrove swamps, rocky headlands, miles of sand-dunes and naked clay hills add to the diversity of the coast line. The whole area has one thing in common—its general dryness and paucity of fresh water. The few perennial streams in the north and in Mekran are small in size and number except after the annual rain, when, for a few days, those in the south may become raging torrents such as the Habb, Hingol, Dasht, Nihing and Mashkel. Jheels too are few—Kushdil Khan and Saranan in the Quetta District, Zangi Nanar in Nushki, Sibi Jheel near Sibi, Sirunda in Las Belas make up about the sum total, while others, such as the Hamun-i-Mashkel, are temporary and get very salt and finally dry.

Plains :

Four large plains are included in our area ; (1) the Chagai, the huge plain (2,000-3,000 ft.) which lies west of Nushki to the Mirjawa Range on the Seistan boundary and between the Chagai Hills on the north and the Ras Koh to the south, some 200 by 80 miles.

(2) the Mashkel Basin, 1,700-2,300 ft. lying on the south side of the Ras Koh and extending from Kharan in the east to the Hamun-i Mashkel in the west ; ornithologically unknown and I believe is largely salt desert.

(3) Sibi Plain between the Kalat highlands, the Bugti country and the N. Sind frontier ; very flat and waterless except at flood times and mostly very bare.

(4) Las Belas plain in the south, wedged in between hills on each side and the sea on the south.

Mountains :

The whole of the north east with Kalat is mountainous with valleys (4,000–5,000 ft.); many of the hills run up to 9,000–10,000 ft. while some—Khaliphat, Takatu and Zarghun in the Quetta District and Takht-i-Suleiman in the Fort Sandeman District top 11,000 ft. The higher hills, 8–10,000 ft., are clothed with briars, junipers, scrub, etc., while in the Ziarat District the juniper develops into genuine forest. The highest tops again are bare while at 7,000 ft. and below there is little tree growth, except where planted and watered, and much of it is very bare hillsides. Great changes have altered Quetta ; in 1879 it was but a small village with few trees where now hundreds of gardens, orchards, plantations and roadside trees are spread over miles of what was bare land.

In the N.W. there is the isolated Chaga Range lying between the great Barechi Plain in Afghanistan and the Nuskhi Plain, south of this there is the isolated Ras Koh rising to over 9,000 ft. and dividing the latter from the Mashkel basin. Both these ranges are unexplored. From Kalat many ranges of hills run south almost parallel and then turn S.W. and finally west (Central Mekran Ranges), all being much broken up by passes and valleys while between the ranges lie plains and water courses with a certain amount of scrub jungle, tamarisk jungle and small cultivation with date palms. These ranges are about 5,000 ft., but become less high in the extreme south and west (2,000–3,000 ft.). The ranges of the Panjgur District and northward drain into the Mashkel basin, the rest of the Mekran waters drain towards the sea *via* the Nihing and Hingol rivers.

Climate :

In the north it is hot but tolerable about 5,000 ft., in summer. Very cold in midwinter with hard frosts and at the higher elevations snow. The whole of the Mekran is excessively hot in summer ; in winter the Central Mekran warm by day and cold at nights, no snow ; on the coast the night temperatures do not fall so low.

Comments on the Avifauna

The avifauna may be said to be almost entirely Palæarctic, with Indian extensions from Sind to the Sibi and Las Belas plains and to a certain extent up the valleys and along the coast, but the general absence of purely Indian forms is noteworthy. The only other Indian species are extensions of the Himalayan fauna into the mountains of the north-east. Of stragglers some are Indian, others Palæarctic.

That there is no clear-cut boundary between the Indian and Palæarctic faunas, I have already pointed out (Ibis, 1922, p. 532), the two faunas tailing off into each other over a considerable area from Sind to East Persia. The first barrier which limits the extension of Indian birds westward is the Desert of Thar and Parkar but quite a number of species have spread across or skirted it and so reached the Indus Valley and its canal systems in Sind. Here many drop out and the Khirthar Range and the desert country west of the Indus forms a barrier which they do not cross ; a list of such species is given in the Ibis, 1922, p. 533, of which I need only quote a few examples such as *Acridotheres ginginianus*, *Laticilla burnesi*, *Prinia flaviventris*, *Anas pœcilorhyncha*, *Inocotus papillosus*, etc. Others again by skirting south of the Khirthar have no hills but only almost waterless desert to cross ere Karachi is reached 110 miles distant. Here a certain number of Indian forms are found which I have been unable to trace further west, that is I could not find them in the Habb Valley nor has any one met with them in the Mekran. Such are :

I. *Cisticola cursitans.*
Turdoides terricolor.
Orthotomus sutorius.
Ploceus phillipinus.
Ploceus manyar.
Pericrocotus peregrinus.
Rhiphidura aureola.
Temenuchus pagodarum
Œnopopelia tranquebarica.

Quite a number of species however reach the Habb Valley (1) and penetrate into Las Balas (2).

II. (2) *Corvus splendens zugmayeri.*
(2) *Dendrocitta rufa pallida.*
(2) *Argya caudata caudata.*
(1) *Prinia inornata.*
(1) *Franklinia buchanani.*
(2) *Pyrrhulauda grisea siccata.*
(2) *Thamnobia fulicata cambayensis.*
(1) *Hirundo smithi filifera.*
(2) *Psittacula torquata.*
(2) *Threskiornis melanocephalus.*

(2) *Lanius schach erythronotus.*
(2) *Lanius excubitor lahtora.*
(1) *Tephrodornis pondicerianus pallidus.*
Acridotheres tristis.
(1) *Mirafra erythroptera sindiana.*
Calandrella craytal adamsi.
Galerida cristata chendoola.
Dicrurus macrocercus.
(2) *Ardeola grayi.*
(2) *Dendrocygna javanica*
(2) *Cursorius coromandelicus.*
(2) *Esacus recurvirostris.*
(1) *Sypheotides indica·*
(1) *Coturnix coromandelicus.*
(1) *Charadrius dubius jerdoni*

The four unnumbered extend to a certain extent outside Las Belas. Other Indian species again find no obstacle to limit their distribution in the Mekran and are found right through to Persia. Such are :—

III. *Pycnonotus leucotis leucotis.*
Lanius vittatus.
Saxicola caprata bicolor.
Gymnorhis xanthocollis transfuga.
Uroloncha malabarica.
Cinnyris asiatica brevirostris.
Streptopelia cambayensis.
Passer domesticus indicus.
Merops orientalis beludschicus.
Caprimulgus mahrattensis.
Dryobates scindianus.
Coracias benghalensis.
Athene brama indica.
Butastur teesa.
Lobivanellus indicus aigneri.
Francolinus pondicerianus.

These two lists, which are composed from facts so far as we know them, do not of course pretend to finality and no doubt when our knowledge of birds in the Mekran is further increased, additions will be made to list II and some from list II will be added to list III.

In list III it will be noticed that all these birds are species which can exist without forest, jungle, cultivation, swamps, etc., and are in fact birds which can exist in desert scrub jungle such as is found throughout the Mekran.

Turning now to the north there are a number of 'Indian plains' species which occur in the Sibi Plain ; but it would serve no useful purpose to list them as the list could not be anything like complete since this plain has been very poorly worked ornithologically, moreover there is little or nothing to limit the extension of many species from Sind to the Sibi District. A certain number may however be said to have extended up out of the plain into the hills and to have a status more defined than a straggler and are resident or summer visitors.

Pycnonotus leucotis leucotis.
Saxicola caprata bicolor.
Saxicola macrohyncha.
Uroloncha malabarica.
Lanius schach erythronotus.
Lanius vittatus.
Anthus rufulus.
Hirundo filifera.
Dicrurus macrocercus
Cinnyris asiatica brevirotris.
Merops orientalis beludschicus.
Dryobates scindianus.
Milvus govinda.
Athene brama indica.
Lobivanellus indicus.
Streptopelia cambayensis.
Francolinus pondicerianus.
Francolinus francolinus.

Others not included in this list are at present best classed as stragglers.

It strikes one immediately how very similar is this list to the list of those species which are found throughout the Mekran ; in fact only three species *Saxicola macrorhyncha*, *Anthus rufulus* and *Milvus govinda* do not occur in one or the other of the foregoing lists and it is quite possible that they have been overlooked there, the two last being resident at Karachi. I think the reason of the extension of these birds into the valleys of North Baluchistan is the same as it is in the Mekran ; they find in the dry valleys at moderate elevations with their sparse scrub jungle, a habitat very similar to that which they are accustomed to in the plains.

Altogether I consider that 55 species may be said to be extensions of the Indian plains fauna ; in the north there are 39 such extensions ; of these about eight are resident and ten summer visitors to the valleys up to about 5,000 feet, the rest only to the Sibi Plain ; and all of these except ten occur in the Mekran.

In the south 25 have extended into Las Belas and in a few cases beyond, while 16 more have extended their distribution right through to Persia ; of all these 24 are also found in the north. Rare stragglers are omitted.

But beyond the 'Plains extensions' and stragglers we have in the north-east a further element which may be called an 'Himalayan extension' and as such I class 13 species while others, which certainly occur in the Himalayas and may well have come thence, are spread over a far wider area than is implied under this heading and are omitted. Some of these are confined as breeding species practically to the juniper forest area of Ziarat and northwards, while others extend to the juniper scrub of the higher hills further west while two or three reach the Kalat highlands and one, the *Suya*, reaches East Mekran and Kirthar. In an excellent paper (Ibis, 1909) Whitehead and Magrath gave an account of the birds of Kohat and Kurram Valley and therein they enumerate all the Himalayan extensions which I now list for Baluchistan except one, *Parus rufonuchalis*, but in addition they were able to list no less than 40 odd Himalayan birds which have not been found within our limits. If one had an equally good paper on South Waziristan no doubt a good many, though *fewer*, Himalayan birds would find a place therein, and so we come to North-East Baluchistan with 13, Kalat highland with two or three and East Mekran with one.

The following I class ' Himalayan extensions ':—

Ianthocincla lineata.
Parus rufonuchalis.
Ægithaliscus leucogenys.
Ægithaliscus concinna.
Sitta kashmiriensis.
Certhia himalayana.
Carpodacus grandis.
Emberiza stewarti.
Phylloscopus indicus.
Suya crinigera.
Myiophoneus temmincki.
Picus squamatus.
Accipter melanoschistos.

Races Peculiar to Baluchistan

Only one *Ianthocincla lineata ziaratensis* is so far as we know entirely peculiar ; two other birds have been described from British Baluchistan, viz., *Corvus splendens zugmayeri*, and *Lobivanellus indicus aigneri*, of these the latter extends to Persia, etc., on the one hand and to Sind on the other, and the former to Sind. The Sunbird, Little Green Bee-eater and Yellow-throated Sparrow were described from over the Persian boundary, the *Suya* from the Sind boundary.

Statistics

381 species are listed with 34 other additional races. Of these 51 may be said to be resident in the north and 59 resident in the south, and showing the diversity between these too areas only 14 are entirely resident in north and south. Again in the north 52 are summer visitors which in the south are passage migrants or winter visitors, whereas in Mekran there are only three summer visitors (*Glareola pratincola*, *Saxicola caprata* and *Merops persicus*) while two more are doubtfully classed as such and an additional two are occasional ' rain' visitors. Many of these summer visitors to the north, are augmented by passage migrants going further north still to Afghanistan, Turkestan, etc., are passage migrants in the south from overseas which come and go by what I have called the Arabian route (Ibis, 1922, p. 531) from and to their winter quarters in Africa. Among such for instance are *Agrobates familiaris*, *Sylvia cinerea*, *Hippolais anguida*, *Muscicapa striata*, *Monticola saxatilis*, *Lanius phœnicuroides*, *Coracias garrula*, *Merops apiaster* and *persicus*, *Glareola pratincola*, *Milvus migrans*, etc. and it is just the fringe of this movement which is to be seen in autumn in Lower Sind.

One can hardly put into statistics the winter visitors and passage migrants as in many cases a species which in the north is a passage migrant is also to a small extent a winter visitor and as soon as the highlands of Kalat are passed it becomes more and more a winter visitor pure and simple as one proceeds south or to a lower elevation. Suffice it to say that over 150 species fall into this category.

49 species I class as stragglers in so much as their claim to inclusion in the avifauna rests on but few and sporadic records, though I think it is probable that quite a few will be found, when the avifauna has been more thoroughly worked, to have an annual status. Of these 23 in the north are from the Palæarctic area and 12 from the Indian region and in the Mekran 9 are from the Palæarctic area and 2 from the Indian region while 3 more *Falco concolor*, *Phœnicopterus minor* and *Puffinus tenuirostris* do not come under either of these headings while some others are doubtful and omitted.

In conclusion it is obvious there is much more yet to be learnt concerning the distribution and status alone of Baluchi birds ; the country has been but scratched. The Quetta District and Kalat have naturally been best worked, the Mekran coast and Central Mekran a bad second, and the Sibi Plain fairly touched; the Mashkel Basin, Nushki Plain and its hills not at all, and the same may be said of the Marri and Bugti country, while large areas in the north-east between Ziarat and Fort Sandeman and the Afghan Frontier have not been worked.

My best thanks are due to Mr. N. B. Kinnear for much help at all times both in India and at the British Museum; to Lt.-Col. R. Meinertzhagen D.S.O., for additional notes to his excellent paper on the Quetta District, to the late Mr. W. D. Cumming for giving me all his notes on the Mekran and Quetta Districts, to Mr. J. E. B. Hotson, I.C.S., for placing at my disposal all his diaries and collections, and to Lieut. E. E. J. L Searight, M.C., for his MSS. notes from Fort Sandeman and Loralai Districts.

[Measurements are in millimeters; wing lengths are maximal, i.e. not on the curve, bill lengths are maximal from frontal bone. The order followed is that of the ' Hand-list of the Birds of India.']

Corvus corax laurencei Hume. The Raven.

The exact status of the two Ravens is not known, which fact only shows that there is much yet to be learnt about even our commoner birds in Baluchistan. Marshall states that *corax* is very common at all seasons and breeds in the mountains round Quetta (which statement Meinertzhagen confirms) whence he obtained a nest with six eggs on March 24. St. John says it is commoner in winter at Quetta than is *ruficollis* and that many nest in the Khojak; Swinhoe recorded it as common at Kandahar and obtained specimens in February and early April. St. John, myself and others all agree that this is *the* Raven which swarms in the Quetta Valley in the winter and roosts like flocks of Rooks in the trees about the town. In August too I saw Ravens there which appeared to be of this form, and found it again common along the Ziarat Road in September. It occurs in the Sibi Plains in winter and Ball found it abundant in the Suleimans in July.

As regards the south of Baluchistan, our knowledge is less complete; Hume states that he saw it at Gwadar in the Mekran in February; W. D. Cumming thinks he saw it near Ormarra in January, while at Charbar he says a larger Raven arrives in October and spends the winter. Although Hotson noted ' Ravens and Crows ' in many places in Central and Coastal Mekran, all his specimens were of *ruficollis* as were Zugmayer's. Records borne out by spcimens are therefore lacking from any part of this area. One cannot however assume, as Dr. Laubmann has, that this Raven is a *mountain* form as it is quite resident and breeds abundantly in the plains of the Punjab.

Corvus corax ruficollis Less. The Brown-necked Raven.

Delmé Radcliffe says that the Brown-necked Raven is common in the Quetta Valley in winter but that there are none there in summer. Swinhoe remarked that it was common everywhere between Quetta and Kandahar; there is a specimen from Chaman in the Karachi Museum. St. John considered it commoner in summer in Kalat than in winter. Meinertzhagen notes it as an uncommon winter visitor to the Quetta Valley. The status of this bird in North Baluchistan clearly wants further elucidation.

There can be no doubt, however, that this is *the* Raven of Central and Coastal Mekran, as all who have collected there testify. It is resident and Hotson found it breeding on March 13 in a hole in a cliff. It is the common scavenger round camps and is familiar and fearless.

The status of the two Ravens in Baluchistan should be easily cleared up; the questions are:—Does *ruficollis* breed in N. Baluchistan or is it only a scarce winter visitor; does *laurencei* occur in the Mekran at all, if so, does it breed; and what are the Ravens of S. Kalat and Jhalawan?

As already pointed out (Ibis, 1922, p. 535) I cannot recognize *infumatus* as a good race; the Brown-necked Raven varies much in size, 5 Mekran females measure W. 360–372, B. 61–69.

Corvus corone orientalis Eversm.

One of a pair was obtained by Meinertzhagen, as he informs me, at Quetta on December 3, 1913. ♂ wing, 357 mm.

Corvus frugilegus L. The Rook.

The Rook is a winter visitor in flocks and in variable numbers each year to the Quetta Valley and districts north to Kandahar arriving about mid-November (earliest 6th) and leaving in March. Swinhoe records them as late as April 21 at Kandahar. I am unable to recognize the race *tschusii.*

Corvus cornix sharpei has as yet not been detected within our actual limits but it occurs at Kandahar.

Corvus monedula sœmmeringii Fisher (—collaris auct). The Kashmir Jackdaw.

Among the Rooks which visit the Quetta-Kandahar Districts are to be seen occasional Jackdaws; they appear to come and depart with their larger relatives. I have examined two birds of the year in the Quetta Museum which showed no trace of the whitish neck collar, but this is not unusual I think in immature birds of the race.

Corvus splendens zugmayeri Laubm. The Sind House-Crow.

Orn. Monatsber, 1913, p. 93, Las Belas.

The Sind House Crow is common and resident at Sibi, but does not appear to have penetrated into the hills.

In S. Baluchistan it extends from Sind only into the Las Belas Plain; I found it common and resident in the Lower Habb Valley and Zugmayer found it throughout the villages of Las Belas. It is absent from Ormarra and the sheer hills west of the Las Belas Plain appears to form a barrier to it; Hotson however, believes that he saw it at Ornach and Korak in the Hingol Valley, N. W. of this barrier; this wants confirming.

The type came from Las Belas and this race is paler on the pale parts of the plumage than the typical race from Bengal, it is not, however, smaller as Dr. Laubmann thought; W. 255–290, in the typical race 256–294 mm.; a large series of both measured.

It occurs at Muscat in Arabia where it must have been introduced.

Pica pica bactriana Bp. The Kashmir Magpie.

'Dazd' (=thief.), 'Shakuk' (Brahui).

The Magpie's distribution in Baluchistan is practically that of the forest. From Kalat northwards and eastwards it occurs very commonly in the more wooded hills such as round Kalat, Mastung, Pishin, Ziarat, Khojak and the hills round Quetta; in the valleys it is naturally scarcer and in the Quetta Valley only occasionally seen, though a few pairs still manage to breed there, but at one time seemed to be at least in winter commoner. Southwards from Kalat Town, it extends to Harboi, Surab to Kalguli on the Panjgur road, and Chuttok, west of Khozdar on the Las Belas Road.

It breeds in junipers, pistachios, etc., and Marshall records fresh eggs on May 15, Meinertzhagen as early as April 10, Barnes gives March and April as the laying months, and no doubt, the time differs according to elevation. Where common, it becomes tame and fearless round houses and evening flights to favourite roosts are to be seen at sunset.

Dendroocitta rufa pallida (Blyth.) The Tree-pie.

'Khata Khan'.

The Tree-Pie extends only into Las Belas where it would appear to be not very common except perhaps in the Pabb Hills whence Mr. Ludlow has eggs taken on April 30 and where too Mr. Wilson has seen it. It very likely may occur in suitable spots at the foot of the Khirthar Range in the Sibi Plain.

Pyrrhocorax pyrrhocorax (L). The Red-billed Chough.

The Chough is naturally a bird of the highest hills, where it breeds. In winter some at any rate descend to the valleys of N. Baluchistan, such as the Quetta valley, earliest September 27, and Kandahar Plain, where they often associate with Ravens. It probably breeds in all the highest hills round Quetta as it certainly does at Ziarat and Kach (8,000—10,000 ft.). Meinertzhagen records a nest on Takatu on May 10. I saw a large flock at Ziarat in September following the plough like Rooks do.

Baluchi and Himalayan Choughs run large as a rule, but I am not quite sure that the race *himalayanus* is distinct enough to be recognized.

Pyrrhocorax graculus (L)(—alpinus auct). The Yellow billed or Alpine Chough.

The status of the Alpine Chough is by no means certain. Natives told Marshall that two kinds of Chough occur and he thought he saw this species at 10,000 ft. in May. Mr. J. N. Cumming says that he has seen it at the tops of Zarghun and Takatu also in May. Meinertzhagen however, failed to find it either there or on Khaliphat or Murdan. Murray states that on his expedition to the Afghan frontier in 1880 *eight* specimens were obtained in March and May, between Quetta and Kandahar by Hutchins and Babington Peile. No specimens appear to exist from Baluchistan and there are no recent records, though there is no reason why this bird should not occur.

Parus major intermedius (Zar.) The Afghan Grey-Tit

This, the palest of the Indian Grey Tits, is resident and breeds in all the higher wooded mountains such as Harboi, the Khojak, Zarghun, Takatu and the Ziarat District, etc. It breeds early on the Khojak where Barnes found incubated eggs on April 10 ; Meinertzhagen records nests on May 3 five feet up in a juniper stump and another in a mulberry on the 25th. In winter it moves down, partially at all events, into the lower valleys and is at that time common in the gardens of the Quetta Valley, etc., but so far has not been noted in the Sibi Plain. Early in October I found it pretty common still in the Ziarat juniper forest consorting with other Tits and Creepers and noted it was feeding on caterpillars and orange berries of a bush so common there.

Besides being paler this race runs a trifle larger than the other Indian races, 5 ♂♂. W., 73–78 ; T. 63–72.

In the list of the ' Birds of the Indian Empire ' Baluchistan is included in the range of *Parus palustris korejewi.* I know of no record of any Marsh Tit in our area.

Parus rufonuchalis rufonuchalis Blyth. The Simla Black Tit.

In the juniper forests of the Ziarat District I found this to be the next commonest Tit to *Æg. leucogenys*, sometimes in pairs, sometimes joined up in bands with other Tits, etc., roving through the forest. Although it is known to breed there, there are no records of its nesting habits. It appears to be practically resident seldom descending to the lower valleys. I found it to subsist in October on small seeds, beetles and the seeds of the orange berries referred to above and it has regular hammering places on boughs of trees whither it takes the berries to extract the seeds. It appears to be confined in Baluchistan to the juniper forest area proped in the N. E. corner. Birds from Ziarat are not separable from typical *rufonuchalis*. *P. melanolophus* is recorded by Radcliffe as common at Ziarat in summer : specimens which he obtained are in the British Museum and are undoubtedly examples of *rufonuchalis* and he admits *in litt* that he must have confused the two species.

Ægithaliscus concinna iredalei S. Baker. The Red-headed Tit.

Marshall records that he saw a pair at Ziarat in May ; Meinertzhagen saw a large party at the same place on July 20. Apparently resident in very small numbers in the Ziarat juniper forest area. I did not meet with it there in September.

Ægithaliscus leucogenys (Moore.) The White-cheeked Tit.

Within our area this long-tailed Tit is only found in the forest area between Ziarat and Fort Sandeman. It is apparently quite resident ; Radcliffe obtained it there in June and Col. Venning in Fort Sandeman District in February. In September and October I found it numerically the most abundant of all the Tits in the juniper forest at Ziarat (8,500 ft.) roving about in parties of 8–12, sometimes associated with other Tits and Creepers but it was a bird exclusively of junipers which it assiduously searches for caterpillars and insects moving in a band from tree to tree much as others of the genus do. It apparently can withstand the cold of winter at this elevation as it has not been observed in the lower valleys.

The type comes from ' The Woods of Balu Chughur ' which is on the Kunar River, N.E. of Jellalabad whence I have seen no specimens ; but Baluchi birds seem to be greyer and paler, not so greenish-olive on the upper parts, and have paler crowns than Gilgit examples but without topo types one cannot differentiate any races. ♂ W., 57, ♀ 53–54. Iris pale straw. Legs and feet pinkish brown.

Ianthocincla lineata ziaratensis, Ticehurst. The Streaked Laughing Thrush.

Bull B.O.C. xli, p. 55, 1920—Ziarat, North Baluchistan.

This Streaked Laughing Thrush is found only in N.E. Baluchistan where at 8,000 feet it is locally fairly common. It is a characteristic bird of bushy nullahs, gardens, etc., rather than the pure forest. Marshall records it from the hills above Harnai, it is common round Ziarat and Col. Venning obtained it at Torkhan in the Fort Sandeman District. In its habits I did not notice any difference to those of the Himalayan bird. In the *Bull. B.O.C.*, xli, p. 55. I separated the Baluchistan bird as a distinct race; it is paler greyer with paler, yellower markings on the breast than even the Gilgit race. W., 80–85.

Argya earlii (Blyth.) The Striated Babbler.

According to Mr. J. N. Cumming the Striated Babbler occurs at Sibi and breeds there in February. This may well be so and the Sibi Plain is the only part of Baluchistan it is likely to occur in.

Argya caudata caudata (Dumont). The Common Babbler.

This is the race of Common Babbler which is found resident in the Sibi plain (but not recorded in the Bolan Pass) and in Las Belas. I have this race from the Lower Habb Valley and by the courtesy of Dr. Laubmann I have been able to examine Zugmayer's specimens obtained in the Mekran. Though these were recorded as *huttoni* all are undoubtedly of the typical race they come from Las Belas, Balaro, west of Hingol River and from the Basul River; all these birds are in a poor state of preservation but they are too small (W., 79–83) for *huttoni* and too yellowish on the upper parts—west of the Basul River this race probably grades into *huttoni*, one that Blanford obtained at Gutader appeared to be intermediate, but specimens from Bahu Kelat, Charbar and Jask appear to be *huttoni*.

Argya caudata huttoni (Blyth). The Afghan Babbler.

'Pinkulag' (Baluchi), 'Susu' (Persian).

Murray records that he obtained three at Quetta and two at Gulistan in about 1880; if this is so, the status of the Babbler must have altered of recent years, as I know of no later record of it in the Quetta Valley though Betham got specimens in the district. St. John recorded that it was common 'everywhere', but he was referring to Kandahar and Kalat. Ball records what is probably this race from the Suleimans but a specimen from Fort Sandeman in which district it is fairly common and resident on the scrub-covered hills is nearer *eclipes*, which appears to be a large, dark, heavily streaked race from Rawalpindi, Peshawar, Campbellpur (south to Kohat ?). *Huttoni* occurs in South Kalat and thence its distribution may be traced south to Jhelawan and the Khirthar and west through Central Mekran to Persian Baluchistan. Replaced by *caudata* in the Sibi Plain, Las Belas and Coastal Makran to Basul R. Eleven specimens examined. W., 85–88·5; B., 21·5–24·5.

Hypocolius ampelinus, Bp. The Grey Hypocolius.

A rare straggler; one was obtained by Duke at Nal in S. Kalat on April 26, 1877; at Jast in Persian Makran, W. D. Cumming saw two on May 1, 1909 and on December 16, 1920, a tired bird came into his compound to drink at Charbar.

Pycnonotus leucotis leucotis (Gould.) 'Bulbul'. The White-eared Bulbul.

In North Baluchistan the White-eared Bulbul is not common above 5,000 feet; below this it is pretty common and resident in groves, gardens and scrub jungle north to Kandahar. In the Quetta valley it is said to be a migrant and not very abundant, arriving in April and leaving in November, it is however recorded in all months except January and February. It is no doubt, to a large extent an elevational migrant and in the Sibi plain it is very common and resident; it breeds at Kandahar in March and must be found too in Nushki District.

Below 5,000 ft. too throughout S. Kalat, Central and Coastal Makran, it is abundant from the Habb Valley to Persian Baluchistan. In Coastal Makran this bird nests in beams and rafters of buildings as well as in trees.

All birds examined from all over Baluchistan are, save one, of the typical race; this one bird from Mand on the Persian-Baluchi boundary, has the yellow eyelids and darker under parts of *mesopotamiæ*; birds from S.W. Persia are of this latter race. Birds from Persian Baluchistan (Zarudny coll.), are however, typical *leucotis* so Dr. Hartert informs me; where the boundary between the two races lies is yet to be determined.

Pycnonotus leucotis humii (Oates). Hume's Bulbul.

There is in the Quetta Museum a locally obtained specimen of this Bulbul which Mr. Kinnear has identified. I am not at all clear about the status of this race.—Other North Baluchi Bulbuls I have seen appear to me to be indistinguishable from the typical race.

Sitta kashmiriensis Brooks. Brooks's Nuthatch.

The only record is from Shingar in the Zhob Valley where Col. Venning obtained specimens on July 7 and June 8 now in the British Museum. Probably this Nuthatch is resident in small numbers in the extreme north-east. I searched the Ziarat forests in vain for this bird nor has any one else met with it there.

Sitta neumayer tephronota Sharpe. The Eastern Rock Nuthatch.

The Rock Nuthatch is common enough and resident in rocky valleys of the mountainous parts especially where there are streams. From Fort Sandeman District in the N.E. it is distributed throughout N. Baluchistan as far as Kalat Town at any rate, and probably further south where hills are high enough though there are no records. In winter it descends to lower elevations. It breeds early; on the Khojak, Barnes records nests in March and April and Betham at Quetta has found incubated eggs on April 2; the foundation of one nest he examined measured 30 by 18 inches; a robbed nest may be repaired and utilized even twice. The number of eggs varies from 5 to 8, Murray records it nesting in trunks of trees as well as on rocks in the Khojak!

Dicrurus macrocercus macrocercus Vieill. The Black Drongo.

'Kolaho' or 'Gohalo' (Brahui).

Where found the Drongo is apparently resident or only a local migrant. In N. Baluchistan its distribution needs further working out. Barnes obtained a bird on May 27 at Chaman 'in breeding state' and remarks that it is very uncommon. St. John says it is not uncommon at Quetta and on the plateau, but does not reach Kandahar. However I do not know of any recent records of it in this district, to which it must be I think a straggler. Lieut. Searight has recently observed a few on passage at Fort Sandeman about the middle of May. It is certainly common enough in the Sibi Plains and penetrates the hills as far, for instance, as Harnai.

In S. Baluchistan it is resident and the distribution so far as is known is as follows:—Starting from the Sind frontier it is common enough in the Habb Valley and throughout the plains of Las Belas; to the north it reaches Khozdar (4,000 ft.) in Jhalawan, to the west it is common in the valley of the Mashkai (3,200 ft.) and reaches as far at all events as the Rodkan District. At Ormarra on the coast Cumming only met with it once. (October 21, 1901). West of long., 64° E. I have no knowledge of it save that Zarudny lists it from Persian Mekran. Hotson however did not meet with it there.

Certhia himalayana limes Meinertz. The Himalayan Tree-Creeper.

The Tree-Creeper is another bird which so far as we know occurs chiefly in the juniper area of N. E. corner. It is resident but moves down to the lower valleys or even perhaps to the plains in winter, at which season it occurs in the Quetta Valley. It is common in the juniper forests at Ziarat (8,000–9,000 ft.) and from there is found out to the N. E. frontier at Fort Sandeman, possibly it may breed in the Khojak too as Murray records it from Gulistan in August. In the autum one or more may be met with with every roving band of Tits. Meinertzhagen (Ibis, 1920, p. 148) records the Ziarat bird as the typical race but later in the *Bull. B. O. C.*, xlii, p. 140–1 he gives reasons for separating it as a new race intermediate between *tæniura* (Turkestan) and *himalayana*. I at first thought that the Ziarat birds were indistinguishable from Turkestan birds but a re-examination with further Turkestan specimens has led me to agree that the Baluchi bird is intermediate in colour between the two and just separable. The bills of Turkestan birds are rather longer than in the other two forms but in *limes* only occasional birds exceed *himalayana* in bill length B., 18–25. (40 specimens in all examined.)

Tichodroma muraria (L.). The Wall Creeper.

The Wall Creeper is not uncommon in N. Baluchistan in winter ; the records date from the end of October to the end of March. One obtained on March 31, is in breeding dress but there are no suggestions that it breeds within our area. It frequents the sides of ravines both in the hills and valleys and occurs as low down as 1,000 ft. in Bolan Pass near Sibi. St. John remarks that he often saw it frequenting mud walls. Unrecorded elsewhere.

The Wren (*Troglodytes t. neglectus*) is recorded in the *Fauna* (ed. ii) from the border hills of Baluchistan. I know of no record within our area, the nearest being from Safed Koh in Afghanistan.

Regulus regulus tristis (Pleske.) The Gold-Crest.

In the *Fauna* (ed. ii) a bird shot at Quetta in January is recorded as being nearer this race. I have been unable to trace the specimen, nor has it been recorded before.

Agrobates galactodes familiaris (Mènèt). The Grey-backed Warbler.

' Surtch Durnat ', Baluchi.

The Grey-backed Warbler is not common in N. Baluchistan and rather local ; it is no doubt mostly a passage migrant and though Meinertzhagen records one at Quetta as early as February 1, the majority appear to arrive and pass through about the last week in April according to Swinhoe, who obtained it then at Melkarez and Chaman. St. John considered it tolerably common in suitable places and obtained specimens in June at Zehur Kalat which must have been breeding and at Nal Kalat in the first week of May. It passes through the Quetta Valley again in August and September (earliest July 30), in small numbers. W. D. Cumming saw several pairs at Saranan on June 26, in tamarisks bordering the dried margins of the lake and at least one pair were feeding young in the vicinity.

In S. Baluchistan it is doubtless mostly a passage migrant ; it has been noted in the valley of the Mashkai, Kohva District, on September 6, and at Ormarra on April 17 and October 11. Some however may overwinter as Hotson records several on December 1, at Nasirabad in the Nihing Valley. On the Perso-Baluch frontier it must breed as Hotson found it near Mand on May 28, and near Hong on July 1, at Charbar on the Perso-Makran coast W. D. Cumming only notes it as a passage migrant from April 14 to May 5.

Acrocephalcus stentoreus brunnescens (Jerd.) The Clamorous Reed Warbler.

This Reed-Warbler in Baluchistan is both a summer visitor and a passage migrant. It is most noticeable on passage at the end of August and in September and it is apparently absent until April. However at Kushdil Khan and other suitable reed beds, as in the Lora River, a few pairs breed ; thus St. John obtained it near Quetta on July 14, and at Kandahar on June 1, whilst Meinertzhagen found two nests with three and four eggs on June 1, near Quetta and a nest of young at Kushdil.

In the rest of Baluchistan the status is uncertain ; at Sibi it certainly occurs in winter and may of course breed there too. There is no reason why it should not breed in the mangrove swamps on the Makran coast as W.D. Cumming found it breeding not uncommonly in such places at Jask in Persian Makran from early April to early May and found nests with two and three eggs. Duke obtained it at Nal in S. Kalat on May 10, but it might have been there on passage only. The rest of the records are scattered ones in winter when this bird is not necessarily found by water as Hotson obtained one out of a flock of Hutton's Babblers in scrub jungle.

Acrocephalus arundinaceus zarudnyi, Hart. The Great Reed Warbler.

Laubmann records that Zugmayer obtained one at Kalat on October 4, 1911. There is no other record for Baluchistan.

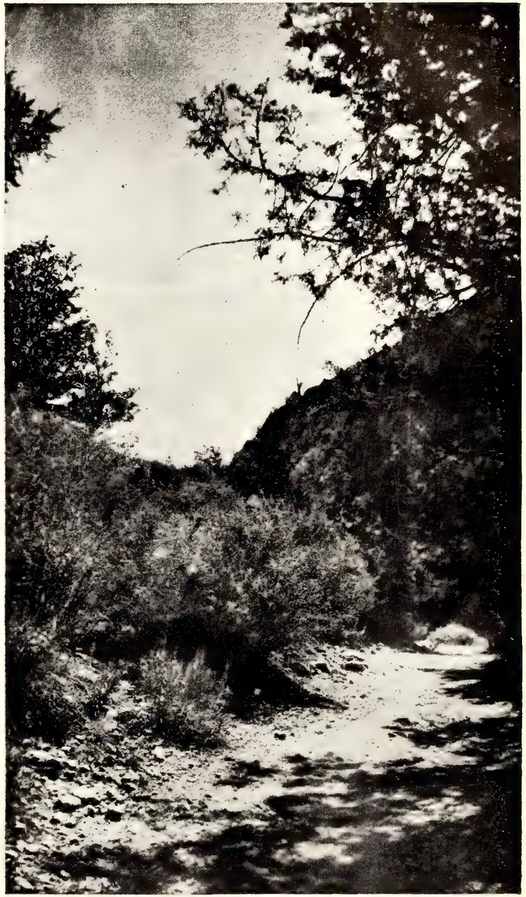
Acrocephalus dumetorum, Blyth. Blyth's Reed Warbler.

Blyth's Reed Warbler is probably not uncommon on passage but has been in the past so confused with other species or has been overlooked that its status

HILLS FROM THE QUETTA PLAIN WITH ORCHARDS.
HOME OF *Rhodospiza obsoleta*, *Kippolais rama*, ETC.

LOW BARE HILLS, SIND—LAS BELAS FRONTIER.
HOME OF *Ammomanes d. phœnicuroides.*

KHIRTHAR RANGE, SIND, BALUCHI FRONTIER
HOME OF *Emberiza striolata* AND 'SEE-SEE'



A 'TANGI' IN THE JUNIPER FOREST DOTTED WITH
WILD ROSE, ETC.
HOME OF *Serinus pusillus*, *Emberiza stewarti*.

cannot be made out. In the Quetta District Meinertzhagen obtained it on March 4, and there are two specimens in the Quetta Museum both obtained on August 31 (and both labelled *Hippolais pallida*) and another obtained on August 24 (labelled—*pallida* and then *Ac. agricola* !). Murray's records of *Acrocephalus streperus* from Nushki and Quetta very likely belong to this species.

St. John records that Duke got it at Nal Kalat on May 10 ; Hotson obtained it at Harbud, E. of Panjgur on April 28, and at Korak in the Hingol Valley on September 13.

Acrocephalus agricola agricola (Jerd.) Paddy-field Warbler.

Only recorded in N. Baluchistan on passage. Meinertzhagen says it passes through the Quetta Valley from the third week in August to the beginning of November and he obtained it at Chaman on April 16. Murray recorded it from Mach on March 16, and from Quetta and Kandahar. There is a specimen in the British Museum also obtained at Chaman on April 16, 1880. Though there are no records, this Warbler is certain to winter in the Sibi Jheels and perhaps elsewhere in Baluchistan. The only specimens I have seen from Baluchistan belong to the typical race.

Lusciniola melanopogon mimica, Madaraz. The Moustached Sedge-Warbler.

Swinhoe obtained this Warbler at Kandahar on April 20, but Meinertzhagen is the only one who has met with it actually in Baluchistan and records that it is not uncommon in the few suitable localities, passing through in March and again in August and September. A few however stop to breed and he found three pairs and their nests—two at Beleli on the Lora on June 1 and 2, both with three eggs and one pair at Kuchlak on May 14, with four eggs. The nests were deep cup-shaped structures of dead reed-stalks situated in dense tangled sedge growing in a foot of water.

Franklinia buchanani (Blyth.) The Rufous-fronted Wren-Warbler.

Though unlikely to occur in the hilly country, this Wren-Warbler, I ascertained, is resident in Habb Valley and may well be so in Las Belas and Sibi Plains. Further there are no records.

Laticilla burnesi (Blyth.) The Long-tailed Grass-Warbler.

This Grass-Warbler is quite likely to occur on the edge of the Sibi plain and is recorded from Pir Chowki at the entrance to the Bolan Pass by Murray.

Hippolais rama (Sykes.) Syke's Tree-Warbler.

To N. Baluchistan Syke's Tree-Warbler is a common but local summer visitor ; it arrives early in April and many have departed by the end of August. Odd birds must winter in sheltered spots as there is one in the Quetta Museum obtained on January 21. It is a bird of the valleys and lower plains particularly frequenting hedges, gardens and tamarisk. Betham records many nests at Quetta on May 14, mostly with 4 eggs, sometimes 5 ; the nests very often in rose bushes, consist of twigs, grass, roots and fibres lined with wool and hair and sometimes feathers. Meinertzhagen found several nests at Khushdil on June 19, situated in tamarisks, from two to three feet up. Also recorded as breeding Quetta (Marshall), Chaman (Barnes) Kandahar (Swinhoe).

There is little information concerning this bird in S. Baluchistan where it should be not uncommon in winter or on passage. Duke obtained several at Nal Kalat in the end of April ; W. D. Cumming informs me that it occurs in small numbers on the Makran coast in spring and autumn. Blanford met with it in Persian Baluchistan in March and April.

Hippolais pallida has been recorded by Meinertzhagen, Murray and Nicoll Cumming as occurring and breeding in N. Baluchistan the former mentioning specimens in the Quetta Museum. I have examined all the *Hippolais* in this Museum and none is *H. pallida*, three so labelled are in fact *Acrocephalus dumetorum.* Nor are there any specimens of *H. pallida* in the British Museum nor in Meinertzhagen's collection. I have examined all Blanford's Persian specimens in the British Museum and there are no *pallida* from any locality east of Bampur in Persian Baluchistan. It is retained in the *Fauna of British India* (2nd ed.), ii, p. 433 on very slender evidence.

Hippolais languida (H. and E.) Upcher's Tree-Warbler.

This Warbler is a local summer visitor in quite small numbers to the hills of N. Baluchistan. Swinhoe obtained one at Chaman on April 28, 1881, and Meinertzhagen records that he found two pairs breeding on the east slope of Takatu on May 31, and on Spereragha on June 11 near Quetta at 7,500–8,000 ft.; the nests were in small bushes 12 to 18 inches from the ground and in each case held 3 eggs. It arrives early in April.

It must be a passage migrant through S. Baluchistan but the only record is from Nundera in Jhalawan where Hotson obtained it on September 8; Blanford obtained it at Magas on the Persian side on March 28 and he called it far from rare in wooded ravines in Persian Baluchistan.

Hippolais scita (Evers) = *caligata* auct. The Booted Tree-Warbler.

Distribution not clear and very few records. St. John says it is not uncommon in suitable places in Kalat and there are specimens of Duke's in the British Museum obtainted at Nal Kalat in the last week of April and one from Kandahar on May 12. Meinertzhagen obtained it at Quetta on April 3, and October 2 and 4. Scarce passage migrant.

Sylvia communis icterops (Ménétr.) The Common White-throat.

Murray records the Common White-throat from Quetta on May 11, Nushki and from Chaman on April 13. Meinertzhagen noticed a family party near Ziarat on July 24, at 7,500 ft. and in the following year on Takatu at 7,000 ft. found a nest in a thorn bush containing 2 eggs and secured the parent for identification. I saw a few at Ziarat from September 25 to October 3 by which date all had departed. It is evidently a scarce and a local summer visitor. On the Makran coast it is a spring and autumn passage migrant but not common.

Sylvia hortensis crassirostris, Cretz. The Orphean Warbler.
'Gaz Burruk', Brahui.

This fine songster is much more of a hill bird than *Hippolais rama*. Meinertzhagen found it arriving in the hills round Quetta late in April and most depart by the end of August. It breeds commonly between 7,000 and 10,000 ft. He found several nests on Takatu between May 31, and June 10, containing 4 to 5 eggs; the nests made of coarse grass with fine grass lining were usually in briar or almond bushes 3 ft. from the ground. Betham found it breeding commonly at 7,000 ft. and records young hatched by May 13, and fresh eggs as late as June 21; he describes the nests as made of bents and twigs and lined with hair. It evidently breeds at Fort Sandeman. Barnes recorded it as common at Chaman, Radcliffe and St. John knew of it breeding near Ziarat. I saw a straggler at Khawash near Ziarat as late as September 28. There are no records in S. Baluchistan where it surely must occur in winter.

Sylvia nana nana. (H. and E.) The Desert Warbler.

The Desert Warbler is rare or else overlooked in N. Baluchistan; Watson obtained it at Sanzal and according to Murray Hutchings got it at Nushki. Murray implies that he obtained it in the Bolan Pass and it is quite likely to occur there and is sure to be found in the foothills bordering the Sibi Plain at least in winter.

In Central and Coastal Makran it is sparsely distributed in suitable places and so far as I know is a winter visitor as it is in Sind; the latest date for it is April 1. However Stuart Baker (*Fauna B. I.*, vol. ii, p. 449) states that this Warbler breeds in the hills of Baluchistan adjoining to Sind, the evidence being some eggs sent to him second hand said to have been taken there at the end of April. I think we must await more conclusive evidence before we accept this species as resident.

Sylvia althea (Hume) Hume's White-throat.

Hume's White-throat is a summer visitor to the Juniper forests of N. E. Baluchistan. Marshall recorded that this species is common in the Ziarat forests in May where Meinertzhagen also found it in family parties from June to the end of August. There is a fledgling in the Quetta Museum as well as an adult. It must breed too in the Fort Sandeman district as Col. Venning obtained one there on June 7; this specimen is in the British Museum and is labelled *affinis*. It very likely breeds on Harboi in Kalat where Hotson obtained an adult in moult on August 16. Most had evidently gone from Ziarat by the end of September when I thought I saw one or two. Except for one obtained at Quetta by Meinertzhagen on April 1, there are no records of this bird on passage and it is unrecorded in the rest of Baluchistan.

Sylvia curruca affinis. Blyth. The Lesser Whitethroat.

The status of this Lesser Whitethroat wants working out as older records are not always reliable. Barnes records it as common at Chaman ; St. John obtained it at Kandahar on July 8, and this and one from Quetta on May 13, are in the British Museum, where there is also one from Fort Sandeman on April 5. In the Quetta Museum there is a local bird obtained on April 23, but one labelled as this race from Ziarat on August 14 I consider to be *althœa.* On the other hand, Betham has recorded that a few remain near Quetta to breed and that he obtained a nest with four eggs on May 13, and found a nest with four young on May 31. The nests were in low thorn bushes. In answer to my enquiry Gen. Betham tells me that he thinks he shot a bird and that it was identified at the Bombay Museum ; he adds that the nests were in low hills near Quetta. I found this species common at Sibi on October 8, where doubtless it winters. In Kalat Duke recorded it as common at Nal at the end of April and there is a specimen thence in the British Museum. There is little information in the Makran ; Cumming tells me he met with it at Ormarra in spring and autumn on several occasions and saw many on August 29. Blanford met with it commonly on the Dasht River, Bahu Kalat and elsewhere near the Persian boundary in winter. Two specimens obtained by Hotson on the Persian side near Charbar and Pahrah are very pale and match with birds from Zaidam, Alashan, and others obtained by Prevalsky in Turkestan and are *halimodendri.*

Sylvia curruca minula (Hume.) The Small Whitethroat.

This race appears to pass through N. Baluchistan on spring and autumn passage during March and April and in October to the third week in November. Meinertzhagen records that he obtained two in the Ziarat juniper forests on July 21 and 24, and saw several others. Unfortunately these specimens were left at the Quetta Museum where, when I went through the collection, I could only find one of them and this, though labelled *minula*, was certainly *althœa.* For the present the suggestion that this race breeds there must I think be put as doubtful. In the Sibi Plain it occurs in winter.

In the Makran this is a common winter visitor up to mid-April affecting bushes and kandi trees by water courses.

Phylloscopus collybita tristis, Blyth. The Siberian Chiffchaff.

In N. Baluchistan the Siberian Chiffchaff is chiefly a bird of passage arriving in the last days of September and passing through again at the end of February and beginning of March ; during these times it is common. A few however certainly withstand the winter in the Quetta Valley as I saw one there on December 12, (when the ground was frozen hard) and there is a specimen in the Quetta Museum obtained in January. It is common at Sibi and no doubt winters there ; Swinhoe obtained it in winter too at Kandahar.

In S. Baluchistan it is a winter visitor in fair numbers remaining there till early April while St. John obtained one at Nal Kalat on April 26. W. D. Cumming noted it at Ormarra on spring and autumn passage chiefly haunting the *Parkinsonia aculiata.*

Phylloscopus collybita collybita (Vieill.) The European Chiffchaff.

Meinertzhagen obtained a bird at Quetta on July 28 which we are unable to separate from the typical race ; it is much greener above than *tristis* and has some yellow on the breast. It is already fully moulted into winter dress and it is probably a waif which had failed to breed.

Phylloscopus indicus, Blyth. The Olivaceous Willow-Warbler.

The only records of this Willow-Warbler are from the Ziarat juniper forests where it is a fairly common summer visitor from 8,000 ft. up ; it probably does not occur outside the forest area. Radcliffe and Meinertzhagen ascertained that it certainly breeds there preferring secluded ravines by water. All had departed when I was at Ziarat on September 25. On passage Meinertzhagen obtained it at Quetta on September 29, and it is recorded from Nushki in May. Radcliffe says it is a restless little bird and frequently utters its call-note—'chick chick chick.' This is another of those species which appear to skip over vast areas of the Indian plains when on passage without halting.

As I have already pointed out, *Sylvia indica* of Jerdon used for this bird cannot be as it is preoccupied by *Sylvia indica* of Vieillot. Fortunately however Blyth described it independently as *Phylloscopus indicus* (*J.A.S.B.*, 1845, p.593).

Phylloscopus nitidus nitidus Blyth. The Green Willow-Warbler.

Only recorded as a passage migrant and only in the north. I saw it in small numbers in the Ziarat forests from September 27 onwards and Meinertzhagen noted it at Quetta in small parties up to November 8. It probably does not winter anywhere in our area. It has been obtained at Kandahar, April 18, and October 30. I think it probable that Murray's record of *Ph. humei* from Gulistan really refers to *nitidus*. These Willow-Warblers were not well understood when he wrote and no one else has met with *humei* since ; one thought to be this in Quetta Museum is *nitidus*.

Phylloscopus neglectus neglectus Hume. The Plain Willow-Warbler.

A common summer visitor breeding in the juniper forest area of Ziarat. After the breeding season it scatters out into the lower valleys before departure and enters the Quetta Valley by mid-August ; however I found it still the commonest small bird in the juniper forest on October 7. Odd ones overwinter in sheltered places as Meinertzhagen obtained one at Quetta on February 8. Murray records it from Pir Chowki in the Bolan and from Sagee beyond Quetta in May ; if correct, they were doubtless on passage. It may breed in Kalat as Hotson obtained two on Harboi early in August in moult.

In S Baluchistan it is a winter visitor in small numbers.

Scotocerca inquietus striatus (Brooks.) The Streaked Scrub-Warbler.

This Scrub-Warbler is not uncommon though locally distributed throughout the length and breadth of Baluchistan affecting more particularly low scrub bushes on hill sides. In summer it is found up to 9,000 ft. and I have seen it at this height in October and it is probably quite resident. It occurs, but less commonly perhaps, in the plains at moderate elevations but not so low as the Sibi Plain ; thus Barnes found it not uncommon at Chaman (4,500 ft.) where it breeds in March. Meinertzhagen in the hills round Quetta found several nests from May 20 to June 7, containing 4 to 6 eggs, the nests being well concealed in thorn bushes and just off the gound. I found family parties of this bird working their way along a dry river-bed feeding in lavender bushes, etc., at Ziarat. Williams records a cuckoo's egg in a nest of this species.

Throughout Kalat, and the hills of Central and Southern Makran this Warbler is common and it occurs at all events in winter as low down as 600 ft.

Suya crinigera striatula (Hume.) The Long-tailed Hill-Warbler.

The Long-tailed Hill-Warbler though very local is found throughout the hilly districts of Baluchistan from the Suleimans and Fort Sandeman District in the N.E. to hills of the Hingol Valley (Kolwa District) and to those bordering Sind nearly to the coast—whence came the type. West of the Hingol I can find no records of this bird. It is doubtless resident where it occurs. All the Baluchi birds belong to this pale race.

Cettia cetti ceottoides, Hume. Cetti's Warbler.

Murray records Cetti's Warbler from the Quetta and Sibi Districts ; it should occur though no one has met with it since. Swinhoe obtained it at Kandahar on January 31.

Prinia gracilis lepida (Blyth.) The Streaked Wren-Warbler.

'Pitak' (Brahui.)

The Streaked Wren-Warbler I found common at Sibi in cultivation, and Murray records it at the entrance to the Bolan Pass. Further up it occurs as a straggler but whether breeds is not clear ; a specimen in the Quetta Museum was obtained at Sharigh on December 17, Meinertzhagen obtained it at Quetta on August 2 whence Murray records it on March 27 and at Kili Abdullah on May 6 ; he regarded it as common but it does not seem to be so now. In Kalat it is unrecorded nor did Swinhoe meet with it at Kandahar. Throughout the

Makran from the Habb Valley to the Persian boundary and beyond it is fairly common in suitable scrub, tamarisk, etc. Hotson met with it in the Kolwa District and it doubtless occurs in other valleys of the Central Makran where it is recorded at 3,500 ft.

Prinia inornata inornata (Sykes.) The Indian Wren-Warbler.

This is one of the Indian plains birds which just reach into Baluchistan. Ball records it in the Suleimans (? Fort Munro District) breeding in July and his specimens were identified by Brooks. I have seen it in the Habb Valley and it is very likely to occur in the Sibi Plain.

Lanius excubitor.

There is a lot yet to be done in working out the distribution of the Great Grey Shrikes in Baluchistan and there has been much confusion in the past; many of the older records appeared under *lahtora* and are certainly incorrect. I can only give the status and distribution of each as they appear to be from specimens I have examined.

Lanius excubitor pallidirostris Cassin. The Allied Grey Shrike.

Records which are borne out by specimens, testify that this is the breeding race of Grey Shrike in N. Baluchistan to which it is a summer visitor. It arrives according to Meinertzhagen, early in March and leaves early in November (latest 23). It breeds locally throughout the Chaman, Quetta, Ziarat and Fort Sandeman Districts and probably is the *lahtora* recorded by Ball from the Suleiman Range; it is not a bird of the highest hills preferring the foothills and valleys, 5,000-7,000 ft. It must move down in September as I only saw one on the Kach-Khawash Road on September 25, which is a favorite breeding ground. It probably breeds in the highlands of Kalat as a juvenile obtained on Harboi appears to be of this race. Meinertzhagen found a nest with 4 young at Spereragha on June 11.

In S. Kalat this bird has been obtained on April 26 probably on passage. To the Sibi Plain it is a winter visitor or a straggler.

Throughout the Makran it must occur at least on passage but certain records are very few; some at all events winter there. Blanford obtained it on the Dasht River on January 25, and at Bahu Kalat on February 3. Zugmayer obtained two shrikes presumably breeding birds in coastal Makran at Gurandani on May 19, and Suntsar, June 11, and at the same time and in the same district—between Pasni and Gwadar. Dr. Laubmann kindly sent these for my examination. The adults, which are very bad skins, certainly seem to me to be *pallidirostris;* they have grey on the lesser coverts, some pink tinge on the breast and no frontal black line; the juveniles in moult also show some pink on the breast.

W. D. Cumming tells me he has watched one of these Shrikes feeding on a fallen peach—a curious diet.

Lanius excubitor aucheri, Bp. Bonaparte's Grey Shrike.

From specimens available this race appears to be a scarce migrant in N. Baluchistan, a few overwintering there. Meinertzhagen obtained it on September 27 and October 2, and I have one from Sheik Mandah on January 29. One in the Quetta Museum obtained at Hirok on June 28, is recorded as being of this race; I failed to find the specimen there. In Central and Coastal Makran it is a fairly common winter visitor from the valley of the Hingol westward, arriving early in September.

Lanius excubitor lahtora, (Sykes.) The Indian Grey Shrike.

Many of the records of Blanford, Duke, Murray, etc., of this race in Baluchistan are not to be trusted. It is the breeding bird of the Habb Valley and Las Belas Plain. Zeugmayer obtained specimens in Las Belas and these I have examined and I think that they are no doubt *lahtora*, the big heavy bill, wide black frontal band, little or no grey on the lesser coverts and white breasts and flanks distinguish them. It very likely extends as far west as Ormarra where some Grey Shrike is resident. Duke obtained two birds at Nal in S. Kalat on May 6 and 9, which presumably are breeding birds and which I assign to this race, they both have heavy bills, wide frontal black band, and very long tails (123 and 125 mm. as against 104-117 in *pallidirostris*) and they have no more grey on the lesser coverts than many Indian *lahtora* have. How far further west and north, if any, this Shrike extends is not known.

In the north it is resident in the Sibi Plain and I thought I saw it up as far as Harnai; how far up the Bolan it extends is not known. Of old records—Barnes's birds from Chaman, St. John's from Kandahar, Blanford's from Mekran, Marshall's from Quetta—all recorded as *lahtora* (those specimens which I have examined), do not belong to this race.

Lanius excubitor przewalskii (Bogdan.) Bogdanow's Grey Shrike.

Meinertzhagen has kindly shown me a male of this magnificent and very distinct Shrike which he obtained at Quetta on November 2, 1913. This not unexpected winter visitor is the breeding race in Turkestan and is a paler grey above, has more white in the plumage and is larger than our other Grey Shrikes.

Lanius vitttatus, Valenc. The Bay-Backed Shrike.

'Nargiani', Baluchi; 'Gunah', Brahui.

To the valleys and plains of N. Baluchistan the Bay-backed Shrike is a summer visitor in fair numbers arriving at the end of March and early April and leaves in mid-August. It even ascends some of the higher hills. To the north-east it is found in Fort Sandeman District and in the Suleiman Range, and to the north reaches Kandahar. Nests with eggs may be found early in May.

South of Kalat it is commoner and throughout Central and Coastal Mekran it is resident as it is in Las Belas and in the Sibi Plain. Its limit westward is about 59° 20′ E. (100 miles west of Bampur in E. Persia). W. D. Cumming informed me that he had a tame bird at Ormarra which he taught to hawk dragonflies!

Baluchi birds are not separable from Indian ones.

Lanius schach erythronotus (Vig.) The Rufous-backed Shrike.

The Rufous-backed Shrike is a summer visitor to the higher plains and valleys of N. Baluchistan under 6,000 ft. arriving early in April and leaving at the end of August, adults going first according to Meinertzhagen. It is the commonest Shrike of this area and extends at least as far west as Nushki. It breeds at the end of April and full clutches, 4-5, may be found early in May. At Sibi it is probably resident and at Kandahar some at all events winter.

In the Makran there are few records; it is resident in the Habb Valley and probably extends to the Las Belas Plain. W. D. Cumming only noted it at Ormarra in spring and autumn, west of which I have no records.

Lanius minor, Gm. The Lesser Grey Shrike.

Mr. Nicoll Cumming says that he obtained this Shrike on Takatu near Quetta in May, however I failed to find his specimen in the Quetta Museum. Murray records that he obtained it at Chaman on April 16, 1880. There is a specimen in the British Museum obtained by Swinhoe at Kandahar on April 14, 1881 and one from Jask in Persian Mekran.

W. D. Cumming tells me he saw a Red-backed Shrike (*L. collurio*) at Sheik Mandah on May 1, 1923. There may be some mistake though there is no reason why it should not occur on passage.

Lanius senator niloticus, Bp. The Eastern Woodchat Shrike.

Stuart Baker identified a bird sent him from Quetta as a Woodchat; (*Fauna B.I.*, ed. ii, vol. ii, p. 300) but there are no details of when and where it was obtained or by whom. No other records in Baluchistan or India.

Lanius cristatus phœnicuroides Severtz. The Rufous Shrike.

'Ganj', Brahui.

There has been great confusion in the past by older authors over the Red-tailed Shrikes. It is certain now however that this Shrike is a summer visitor to N. Baluchistan arriving early in March and leaving at the end of August. It nests in the higher hills and valleys between 6,000-9,000 ft. that is from just below tree limits upwards. It breeds on all the higher hills round Quetta as Murdan, Takatu, Khaliphat and at Ziarat; Meinertzhagen found nests in low thorn bushes and noted both greenish and pinkish types of egg; 5 is the usual number.

Throughout Central and Coastal Makran it is a passage migrant and fairly common passing through, as in Sind, in August and September for its winter quarters further south ; it possibly breeds in the Panjgur District, Central Makran.

Lanius isabellinus, H. and E. The Pale Brown Shrike.

There are old records of Marshall and Radcliffe of the supposed breeding of this Shrike in the hills of N. Baluchistan but as none is borne out by any specimen it may be taken that the records really refer to *phœnicuroides*. It is a fairly common passage migrant commoner in spring than in autumn and here and there a few overwinter. I found it very common at Sibi in October ; Swinhoe records it as common at Kandahar in winter and there are several specimens in the British Museum thence.

As regards Central and Coastal Mekran nothing can be said. Blanford remarked on its absence, Hotson did not obtain it, Cumming says it is a passage migrant in September and March at Ormarra. It should occur but there are no specimens from the Mekran. Laubmann says a young bird obtained by Zeugmayer at Panjgur on July 28, may be this or *phœnicuroides ;* it is much more likely to be the latter.

Tephrodornis pondicerianus pallidus, Ticehurst. The Wood Shrike.

Only known from the Habb Valley whence I have seen a specimen, it might extend to Las Belas. The only other likely locality is the fringe of the Sibi Plain.

Pericrocotus brevirostris brevirostris (Vig.) The Short-billed Minivet.

There is in the Quetta Museum a specimen obtained at Sibi on December 11th ; it must be a straggler in winter, as it is in Sind, and no doubt would be only found in the plains.

Pericrocotus perigrinus. The Small Minivet.

According to Murray, Bingham obtained a male and two females at Quetta on August 23, 1881. This Minivet may quite well occur in the Sibi plains and wander up to Quetta occasionally but no one else has met with it. It may well occur too in Las Belas.

Oriolus oriolus oriolus (L.) The Indian Oriole.

A bird W. D. Cumming obtained at Charbar on October 24, is in the Quetta Museum and some noted in a cyclone at Ormarra on May 5, probably also belonged to the typical race on passage.

Oriolus oriolus kundoo, Sykes. The Indian Oriole.

This Oriole is a summer visitor to the Quetta Valley and here and there onwards to Kandahar. It is not very common and suitable places are few. It arrives early in April nesting in the gardens and orchards during the last half of May. Unrecorded elsewhere, but Lieut. Searight has noted a few at Fort Sandeman from the last week of April till mid-June.

Pastor roseus (L.) The Rosy Pastor.

Northern Baluchistan is the high road of the Pastors' migrations to and from India ; large flocks have been noted almost daily at many places in the Quetta Valley, Chaman, Kalat, Kandahar, etc., halting on their westward migration in spring from mid-April to mid-May, and again on return passage which begins at the end of the first week in July. The same movements in smaller numbers are witnessed in the Central and Coastal Mekran districts. This east-west migration of the pastor in spring and the reverse in autumn is one of the most remarkable migrations of any species in the Indian Fauna and I have already (Ibis, 1922, p. 616) traced the movements of this bird from the plains of India through Baluchistan and Persia to its breeding grounds in Asia Minor. The only other species whose movements are at all comparable is the Black-headed Bunting.

Though no doubt many take the route down the Bolan Pass to the plains others strike through the hills further to the north-east as it occurs on passage in the Fort Sandeman District and Ball has noted daily movements throughout July from Suleimans to the plains at Dera Ghazi Khan. Further north Whitehead and Magrath noted the same huge bi-annual migrations at Bannu and Kohat in N.W.F.P. and remarked that a few might be seen throughout the summer. Meinertzhagen noted a pair at 9,000 ft. at Ziariat on June 7, and the question arises : Do any breed in N. Baluchistan and in the N.W.F.P. ? ; it is possible though no one has as yet found a nest, but I think it more than likely that there may be colonies in Central Afghanistan which is *terra incognita*. The fact that birds may be obtained in May with organs much enlarged or in July with incubation patches does not prove nesting in the vicinity with this bird as the same phenomena can be seen in Lower Sind. The Pastor is one of the very few birds whose organs enlarge practically to breeding size ere they migrate and as it returns to winter quarters before moulting, birds with incubation patches may be obtained hundreds of miles from the breeding grounds. The Pastor does not winter in N. Baluchistan and only odd ones even appear to do so on the Makran coast. It may winter in the Sibi Plain and Las Belas.

Sturnus vulgaris poltaratzskii, Finsch.
Sturnus vulgaris nobilior, Hume.
Sturnus vulgaris dresseri, But.
Sturnus vulgaris porphyronotus, Sharpe.

To N. Baluchistan the Starling is a winter visitor in small numbers in suitable spots and is commoner perhaps at lower elevations as at Kandahar and Sibi. As regards what races occur I can only judge by specimens I have seen, as some of the older records are not be relied on. Thus *humii* and *purpurascens* have been recorded but I have seen no specimens of either in any of the museums. Judging then by specimens, *poltaratzskii* is the commonest and then *nobilior* ; of *dresseri*, if it be a good race and not a variant of *porphyronotus*, I have seen specimens as well of typical *porphyronotus*. Meinertzhagen has shown me two starlings which he obtained at Quetta on March 13 and 18, 1913, which certainly are not distinguishable from *caucasicus* ! But not every example of *nobilior* is distinguishable from *caucasicus* ; in the former the crown and upper throat is purple, in the latter green, but I have seen Kandahar breeding birds quite indistinguishable in these respects from Caucasian examples and also odd Caucasian birds with distinct purple sheens instead of green on these parts.

A few starlings are found here and there on the Makran coast in winter from the end of August till April and they no doubt occur too in Central Makran. From the Makran coast I have seen both *poltaratzskii* and *nobilior*.

Acridotheres trtstis tristis (L.) The Common Mynah.

In N. Baluchistan the mynah is common and resident in the Sibi plain but does not appear to be habitually found in the valleys ; I did not notice it in the Bolan nor at Harnai ; Radcliffe however has met with small flocks in the Quetta Valley in July and August and Marshall noted odd ones chiefly in March and April. These appear to be merely wanderers.

In the south its distribution is curious ; it is common enough on the Sind boundary in the Habb Valley and is resident, as it is too in the Las Belas Plain whence it was recorded by Masson as long ago as 1844 and confirmed by others in recent years. North of this I only have one record—Hotson found it at Ornach in the Dhor Valley which place it may have reached by ascending the Larali River from Las Belas. Along the coast Cumming never once saw it at Ormarra but Blanford noted it in ' villages of any size ' near Gwadar but not inland. St. John who was with him says he only met with it at Pishin. Hotson however found it at Mand, the Perso-Baluch frontier post, and at Nasirabad and Tump in the Nihing Valley not far distant from Mand. It is possible it has been introduced at Gwadar and has spread inland to the Nihing Valley or it may have extended along the coast. Zarudny lists it as resident in South Persian Baluchistan. A specimen of *Acridotheres ginginianus* in the British Museum labelled ' Kandahar ' must be an escape or wrongly labelled. I know of no record of this Mynah in Baluchistan and it is not likely to occur except perhaps just over the N. Sind Frontier.

Muscicapa striata neumanni Poche. The Spotted Flycatcher.

The Spotted Flycatcher is an over-seas summer visitor to N. Baluchistan breeding in the forest area from 7,500 ft. up ; at lower elevations it is a passage migrant arriving at the end of April and early May, and passing again in September till mid-October. It breeds commonly round Ziarat and full clutches (4–5 eggs) may be found at the end of May. I noticed a few still in their breeding haunts to the end of September but most had gone.

To Central and Coastal Makran it is a common passage migrant. W. D. Cumming noted it on passage on the coast on April 26 and May 5, and again on September 10, but it has been met with up till mid-October. There are no winter records.

In the *Fauna of British India*, ed. ii, vol. ii, p. 205. Baluchistan is included in the breeding distribution of *Hemichelidon sibirica gulmergi*. I know however of no record at all of this Sooty Flycatcher in Baluchistan.

Siphia parva parva (Bechst.) The Red-breasted Flycatcher.

The Red-breasted Flycatcher is a common passage migrant in N. Baluchistan arriving early in March to early May and returning about the third week in September (earliest 13) to the end of October ; Meinertzhagen has obtained it at Quetta as late as December 3. During the height of autumn passage it is very common in suitable places ; thus I found it very numerous at the end of September at Ziarat and on October 8 at Sibi it was swarming. W. D. Cumming informs me that he saw several at Ziarat on May 27, but it has not been proved that it breeds there.

It is rather remarkable that I have no records of this bird in Central and South Baluchistan, it has possibly been overlooked as Blanford met with it not uncommonly on March 22, at Dizak in Persian Makran. The migrants in N. Baluchistan come no doubt largely from the plains of India. This Flycatcher does not appear to winter in Baluchistan except possibly in the Sibi District.

Laubmann records a bird from Pishin as *S. p. albicilla* though he says he is unable to determine the race ; but doubtless this bird is of the typical race as are all Baluchi birds I have seen.

Murray records *S. p. hyperythra* as common at the end of March and early April and mentions specimens from Quetta and Chaman. No one has since met with this race and I think Murray must have mistaken males of the typical race for the Kashmir bird.

Tchitrea paradisi turkestanica Zar. The Paradise Flycatcher.

The Paradise Flycatcher appears to be a summer visitor to N. Baluchistan in very sparse numbers, though St. John regarded it as not uncommon in the Khwaja Amran and other wooded hills, it reaches Kandahar. It occasionally occurs in the Quetta Valley in spring and in 1913 and 1914 Meinertzhagen thought that some tried to nest in the gardens there. The earliest date I have note of it is April 17 (Kandahar) and latest September 23 (Pishin). However, Lieut. Searight informs me quite a number arrive at Fort Sandeman in the first week of May and they breed there and in the Kuchmina Valley.

There are no records in Central and S. Baluchistan. I have already pointed out (Ibis, 1922, p. 626) that this race is recognizable by its paler upper parts in the chestnut dress from the Indian peninsular bird and it winters in the plains.

Saxicola caprata bicolor (Sykes). The Pied Bush-Chat.

The weight of evidence is that the Pied Bush-Chat is a summer visitor throughout N. Baluchistan arriving at the beginning of March and nesting freely in the valleys and plains at about 5,000 ft., but also in smaller numbers up to 10,000 ft. Marshall and W. D. Cumming say that it leaves in October and the latest date is November 11. St. John therefore must have, I think, either made a slip or else the birds' status has altered when he recorded it as common especially in winter 'a few remaining to breed at Quetta and Kandahar.' It is certainly now one of the commonest birds in the Quetta Valley in summer. It nests at the end of April and early May.

To the east of Baluchistan it appears also to be a summer visitor ; W. D. Cumming thought it was so in the Coastal Makran and I have no winter records thence ; Hotson noted it only from April onwards and then only here and there in Central Makran. On the coast it breeds earlier than in the north ; Cumming noted one excavating a hole in the side of a nullah and building on March 9, and found a nest with young on April 12. So it may possibly be a resident as it is in Sind. It extends as far west as Bam in E. Persia and is said to occur as a straggler at the head of the Persian Gulf (Zarudny).

Birds from Baluchistan and Sind are indistinguishable from those from Turkestan (*rossorum*) on the one hand and from those from the Deccan (*bicolor*) on the other, the types of both of which I have examined ; I therefore regard (*rossorum*) as a synonym.

Saxicola torquata indica (Blyth.) (= *maura F. B* 1., ed. i.) The Indian Stone-Chat.

The Indian Stone-Chat is a common summer visitor to the higher valleys of N. Baluchistan breeding there about the end of May at and above 7,000 ft. I found most had left their breeding quarters in the Ziarat Valley and Khawash by September 24, and most depart for the winter altogether, though a few may be found here and there in lower valleys and plains, as at Quetta and Kandahar, while to the Sibi plain it is probably a winter visitor. Extreme passage dates are March 1 and November 11.

To Central and Coastal Makran it is a winter visitor arriving as early as August 23, but it does not appear to be very plentiful. All Baluchi and Kandahar specimens examined are *indica*.

Saxicola macrorhyncha (Stol.) Stoliczska's Chat.

Murray records this very local desert-loving Stone-Chat from the Bolan (Bibi Nani) and Chaman and mentions also specimens from Dubrai and Kandahar. No one has since met with it and I should feel inclined to regard these records as a mistake but that Swinhœ himself records it from Dubrai, April 24, and Kandahar April 19, 1881 and his specimens are in the British Museum. As elsewhere where it is found (Punjab, Sind, Rajputana), it must be very local and resident.

Œnanthe monacha (Temm.) The Hooded Chat.

Of all the Wheatears this is the most local and the most addicted to dreary desert hills and plains. All the records come from the Makran coast and date back to the days of Hume and Blanford. It must occur here and there along the Makran and Blanford says a favourite resort is the sand hills of the coast. Bahu Kalat is the furthest north, there is any record of it for certain. It is presumably resident but all the records refer to winter November 27 to February 15, at which period only were these observers in the Makran. In the north there are three records all probably erroneous—Barnes says he saw it at Chaman, Marshall thinks he saw it at 10,000 ft. in May and Murray says it was 'extremely common' in the Bolan and at Dinah Karez in March and April. It might occur near the Bolan as it occurs in the Sind Kirthar.

Œnanthe alboniger (Hume). Hume's Chat.

'Monu' Bal. (for all pied-chats).

Hume's Chat is fairly common in the hills of the Makran coast, it is found in the hills round Mand and Hong on the Perso-Baluch frontier and probably throughout the Central Makran range to the Kirthar and the Kalat Hills. In the north it is found here and there but its distribution is not clear. Venning has obtained it at Fort Sandeman and at Lakabund (5,700 ft.) breeding. St. John records it from S. Afghanistan and Kalat and says he found young in May. At Kandahar Swinhœ recorded it as a winter visitant (probably elevational) leaving the district by mid-February. In the Quetta Museum there is a pair (labelled *picata*) which were obtained at Mach in the Bolan Pass on November 16, 1911. Murray records it from Chaman District in April, Mach in March and Kirta, also in the Bolan, in May. Wherever it occurs I believe it to be resident or only elevational in migration.

Œnanthe opistholeuca (Strickl.) Strickland's Chat.

Strickland's Chat, judging from the few records, is a scarce passage migrant or winter visitor in the north though possibly it breeds in the extreme north east. Barnes says it occurs very sparingly at Chaman ; St. John obtained two at Kandahar in February and March. Meinertzhagen saw a pair at Quetta on February 24, and obtained one there on October 21. There is one in the Quetta Museum shot at Baleli on March 18 while I secured one at Quetta on August 19. Venning got one at Shinghar (8,100 ft.) in the Zhob Valley on

June 21, which presumably must have been breeding. Murray recorded several from the Bolan Pass in March and the Khojak on April 17.

Œnanthe picata (Blyth.) The Pied Chat.

The Pied Chat is one of the most universally distributed of the summer visitors to the hills and valleys of N. Baluchistan and is the most numerically abundant of its tribe. It arrives early in March (corresponding to the time it leaves Sind) and breeds at from 5,800 to 11,000 ft. Eggs are recorded as early as April 12, and young out by the 29th, though most do not have eggs—5 to 6,—before the end of April and these have been found up to the end of June so that it may be double brooded. Holes under stones or in rocks, holes in walls or in steep river banks are usual nesting sites, while holes under eaves of houses, wood stacks and even, according to Murray, in holes in pistachio trees are sometimes used. I think a number have departed by mid-August as on two days at that time I enumerated all I saw about thirty males and ten females—all adults—and in Sind the first are back again in July ; most have departed by early September but an odd one may occasionally be found during the winter (Kandahar, Quetta, Mach.)

How far south in Baluchistan this bird breeds I do not know, it certainly breeds from Fort Sandeman District in the N. E. across to Harboi in Kalat ; south of this there is no certain record of its breeding. To the whole of Central and Coastal Makran it is however a common winter visitor and the latest date for it is March 20. It is a winter visitor too to the Sibi Plain. Hotson remarks on the scarcity of females a fact which I too noted in Sind.

Œnanthe capistrata (Gould.) Gould's Chat.

I have elsewhere (Ibis 1922, pp. 151–5), gone very fully in to the arguments for recognizing this bird as a separate species and not as a dimorphism of *picata* ; besides differences in plumage and average size it has a very different distribution. In the north whereas *picata* is a common summer visitor *capistrata* is but a rare non-breeding vagrant. Marshall records one at Sibi in February one was obtained at Chaman in March 1901, Meinertzhagen got one at Quetta on August 21 and W. D. Cumming another on March 19.

The only records in the south are two obtained by Blanford in the Habb Valley on February 18, 1877. It is equally rare in Sind.

Œnanthe leucomela (Pall.) The Siberian Chot.

St. John records this wheatear as common on spring and autumn passage, at Pishin at the end of September and at Kandahar from March 2 onwards, whence there are three specimens in the British Museum ; there is also one from Quetta obtained by Blanford. I obtained one at Ziarat 8,500 ft. on some old plough land on October 5. It appears to be one of the rarest of its tribe and I therefore do not credit Murray's statement that he found it 'extremely common' in the Bolan Pass below Mach.

I have no record of it in S. Baluchistan but it must occur on passage ; a curious record is of one in the Indian Ocean 6° 21 ′N 66° 39. E due south of the Makran and about half-way between Ceylon and the Somali coast !

Œnanthe finschii barnesi (Oates.) Barnes's Chat.

This fine Wheatear is a winter visitor in fair numbers to the valleys and higher plains of N. Baluchistan ; though it is recorded as early as September 9, near Quetta and September 12 at Kandahar it mainly arrives at the end of the first week of October. Meinertzhagen and Cumming have both noted a preponderance of males, in the few I have seen the proportion of sexes was about equal. It is a bird of the bare plains and the base of stony hillsides. Murray was probably mistaken in saying that this bird was more or less common in the Bolan Pass in May.

Though I have no record of it in Central or Coastal Makran it may occur in the former district as Hotson obtained it beyond the Frontier in Persian Baluchistan in October. I have elsewhere given as I think sound reasons for retaining an eastern form of this bird (Ibis, 1927) the greater size, the colouration and lack of the blackish throat in the female distinguish it from the Egyptian bird.

Œnanthe œnanthe The Common Wheatear.

The Wheatear is a straggler on passage in the north ; Meinertzhagen obtained a male on March 17, at Quetta and a female on October 18. The latter is in the Quetta Museum but when I examined it I had no material at hand for comparison ; many female Wheatears, but not all, east of the Mediterranean are paler than any typical European birds and these for the time I call *rostrata* of Hemprich and Erhenburg. (See addenda to *Birds of Iraq*, p. 103 of this volume).

Œnanthe isabellina (Crtz.) The Isbelline Wheatear.

'Gidik', Brahui (all wheatears).

In the north the Isabelline Wheatear has a mixed status ; it is a common winter visitor and passage migrant while a certain number are either summer visitors or are resident, some nesting in some years more than in others. The passage movements take place about mid-March and again at the end of August to late in October. Possibly some are resident as Barnes records young at the end of March but April appears to be the main month for eggs. As elsewhere it is a local bird. The nests—pads of cotton, wool and feathers—are situated in holes in the ground, resembling rat holes, and are two feet or more from the entrance, according to Betham. It is almost certainly double brooded as Betham found a clutch of five eggs on June 2, in a nest which on May 7, had held young. The usual number of eggs is 5 to 6.

Whether it breeds in Central Makran is not clear, it is fairly common there throughout the winter and Hotson obtained it at Panjgur on April 1, but Zeugmayer who was there in June did not meet with it. In Coastal Makran it is found from October to March, as in Sind.

Œnanthe deserti atrogularis (Blyth.) The Desert Wheatear.

Throughout most of Baluchistan the Desert Wheatear is in suitable places a common winter visitor and probably is the commonest of its tribe. In the north many leave for the coldest months and so is there mainly a passage migrant, most passing through in October and again in March to the end of April. Whether it breeds or not in N. Baluchistan is a matter which wants clearing up ; no one of recent years has found it nesting. Marshall records a nest of young at Quetta on May 24 and Duke obtained two specimens (in Brit. Mus.) in S. Kalat at Surab and Gahdegan on May 20, 1877. Marshall's nest was situated in the side of a bare bank of mud and concealed under the roots of a dead shrub, as it contained three young nearly fledged he ought not to have made any mistake over the identification. I saw two or three in the Quetta Valley on August 18, which is early for passage migrants to be there. The latest date Meinertzhagen has seen it is April 29.

To the Sibi plain and the whole of the Mekran it is a common winter visitor latest date March 29.

Œnanthe deserti oreophila (Oberh.) The Tibetan Desert Wheatear.

As I have pointed out (Ibis, 1922, pp. 155–8) this race of Desert Wheatear is the breeding bird of Ladak and Tibet and winters amongst other places in Baluchistan but not in the plains of India. Its numbers in Baluchistan are swamped by those of *atrogularis* but it occurs doubtless throughout Central and Coastal Makran at least on the west side (Pasni February, Gwader December, as well as in Persian Mekran and Persian Baluchistan) and in N. Baluchistan at least on passage (Kandahar September 14 Quetta August 26, February 28, March 3, Gatai April 26).

Œnanthe xanthoprymma chrysopygia (De Fil.) The Red-tailed Wheatear.

The Redtailed Wheatear is a winter visitor in small numbers and the records are scattered over various places from the north right down to the Makran coast. It probably occurs in small numbers throughout the country. I have always found it to be a bird of bare and desolate spots with a distinct liking for the foot of rocky hillsides. Meinertzhagen has seen it as early as August 18, at Quetta, but most come later. It may be found almost at any elevation, it has been obtained on Khaliphat, 11,000 ft., in November and I have seen at as low down at Nari Bank, 600 ft. in September.

I can hardly credit that Murray obtained six birds, as he records, at Mach on May 19 ; it seems a very late date. I know of no record of this bird nesting in our area though Baluchistan is given in its breeding range in the new edition of the Fauna.

It is noteworthy that all the Wheatears of British India occur in Baluchistan.

Chaimarrhornis leucocephala (Vig.) The White-capped Redstart.

Meinertzhagen obtained this Redstart on March 2, and saw another at Baleli on April 14, in each case the bird was on rocks by running water. There are two in the Quetta Museum obtained at Manji on November 19, 1915 and at Baleli on November 7. I think it is rather remarkable that this bird whose nearest known breeding quarters are in the Safed Koh should wander in winter to parts where running streams are so comparatively few.

Baluchistan seems to be included in the distribution of the Plumbeous Redstart (*Rhyacornis fuliginosa*) in the new edition of the Fauna ; I know of no record of this bird in Baluchistan.

Phœnicurus erythronotus (Evers.) Eversmann's Redstart.

Eversmann's Redstart is a common winter visitor from October to March from Fort Sandeman to Kalat and from Kandahar to the Quetta Valley. Elsewhere there are no records. Murray records it from Dozan on May 17 ; he records also *Ph. hodgsoni* from Gulistan in May ! No one else has ever met with this Redstart west of Nepal and therefore I think we must disregard both of these records.

Phœnicurus ochrurus phœnicuroides (Moore.) The Western Indian Redstart.

To the afforested area of N. Baluchistan from Kalat to Fort Sandeman this Redstart is a summer visitor breeding at from 7,000 to 11,000 ft. and is one of the commonest birds in the forest. It nests from the middle of May on wards and clutches of 3 to 5 eggs are recorded ; the nests are made of grasses, juniper bark and feathers. On October 7, I found it still the commonest bird in the juniper forest ; in winter it seeks the lower valleys and plains such as Quetta, Kandahar, Sibi and no doubt many migrate to the Indian plains.

To Central and Coastal Mekran it is a winter visitor and is common enough in sheltered rasines, etc.

Cyanosylvia suecica pallidogularis (Zar.) The Indian Red-spotted Blue Throat.

This Bluethroat is a common passage migrant in N. Baluchistan passing through in September and October, earliest September 22, and again in March and April, earliest March 4 ; on October 5, several arrived in the juniper forest at Ziarat 9,000 ft. but immediately passed on. It winters in the Sibi plain and odd ones do so in sheltered nooks in the valleys as there is one from Quetta in December in that Museum.

To Central and Coastal Makran it is a winter visitor wherever cover is sufficient.

All specimens I have seen except one are referable to this pale-throated form.

Cyanosylvia suecica suecica (L.) The European Red-spotted Bluethroat.

One which Meinertzhagen obtained, a male in full dress, on March 26, at Quetta neither he nor I can separate from the typical race ; the blue is much darker than in *pallidogularis*.

Murray records that Barnes obtained a pair of the White-throated Robin (*Cossypha gutturalis*) at Chaman on July 2, 1880 and that Watson obtained one at Quetta in June. No one has met with this bird since and Barnes who published his second paper on Chaman birds in *Stray Feathers* in September 1881 does not allude to it. I think there must be some mistake on Murray's part ; he says he never met with this species himself.

Luscinia megarhyncha golzii (Cab.) The Eastern Nightingale.

A Nightingale was obtained in Quetta on October 1913 and another in the Quetta Museum was shot locally on April 30, 1909. Meinertzhagen obtained one there in February. Nightingales are rather frequently kept as cage birds and it is possible all these were escapes.

Thamnobia fulicata cambayensis (Lath.) The Brown-backed Indian Robin.

The Indian Robin is one of the Indian plain species which penetrates into Baluchistan where the plains abut. It is found in the Sibi Plain and Murray records it in the Bolan Pass at Pir Chowki and near Mach, but I can hardly believe that it occurs as he says at Sagee on the Quetta—Chaman Route. In the Suleiman Hills it occurs according to Ball who found it at 'tolerable elevations' west of Dera Ghazi Khan. It may well occur too in the low hills of the Bugti and Marri country between Kashmor and Sibi. This district has never been worked.

It enters Baluchistan again in the Habb Valley where it is common and resident and it extends throughout the Las Belas Plain, the high hills to the west of which appear to form an effectual barrier since I have no records further west.

Turdus merula intermedia (Richm.) The Blackbird.

It is somewhat surprising that there are no very good records of the Blackbird in N. Baluchistan. Murray said that this species was common between Quetta and Kandahar and in the Bolan Pass, in March. It certainly occurs in winter at Kandahar where Swinhoe records it as common and so it may occur at times within British Territory but I can hardly believe it is found in the Bolan. Nicoll Cumming says that a Blackbird occurs at Ziarat and on Urak in summer but I think there must be some mistake, no one else has found it there. I have examined two winter birds from Kandahar in the British Museum and they both belong to the form *intermedia* and not *maxima* as has been recorded.

Turdus atrogularis (Temm.) The Black-throated Thrush.

The Black-throated Thrush is a winter visitor to the whole of Baluchistan. In N. E. Baluchistan it arrives about September 25, and there I found it in small flocks in the juniper forest at 9,500 ft. becoming increasingly common till it swarmed at the end of the first week in October. Nearly all were adult males. As the weather begins to get colder and food supply diminishes it comes down to the lower valleys and plains arriving there early in November and leaving again early in April; it is more abundant in some years than in others.

In Central and Coastal Makran too the numbers vary each year (as in Lower Sind) according to the weather further north, since being dependent on open weather for its food supply it must needs migrate if frosts or snow are prolonged. It reaches the actual coastline in some years when northern conditions are bad. It is, outside the forest area, a bird of gardens, groves and cultivation.

St. John records that his collector obtained Tickell's Thrush (*Turdus unicolor*) at Quetta in 1882 and that it was identified by Blanford. St. John's birds went to the British Museum but there is no specimen of his there of this species so there may be some mistake although the specimen was originally catalogued there as *unicolor*.

Turdus viscivorus bonapartei (Cab.) The Missel Thrush.

The Missel Thrush is local and resident in N. Baluchistan only. It breeds fairly commonly in the juniper forest area at Ziarat, on Takatu, Zarghun, all above 8,500 ft., and probably on Urak, and Harboi in Kalat. Meinertzhagen records a nest with 3 eggs on April 4 and Marshall a nest with 4 eggs on May 1, both situated in junipers. In winter this Thrush moves down to lower valleys and occasionally to the Quetta Plain but not to Kandahar or Sibi Plains.

Baluchi birds are very pale on the upper parts and my fresh moulted specimens are paler than most Himalayan birds but I have seen odd ones from Persia and elsewhere as pale and there are several other races described which I have not seen. Missel Thrushes vary much in colour of their upper parts. My specimens measure W., ♂ 162·5 ♀ 157·5 and Meinertzhagen's ♂ 172 ♀ 163.

Monticola solitaria pandoo (Sykes). The Eastern Blue Rock-Thrush.

This race of Blue Rock-Thrush is a summer visitor to the higher hills of N. Baluchistan where it breeds from 7000–10,000 from Kalat to Fort Sandeman. It arrives in March and eggs are recorded in April and up to May 23—3 to 4 in number. It appears in the Quetta Valley by the last days in July and all move away during the next month ; I found all had left Ziarat district by the third week in September.

Monticola solitaria longirostris (Blyth.) (=*transcaspicus* auct.) Blyth's Blue Rock-Thrush.

This is probably the form which inhabits Baluchistan in winter : at all events winter birds which I have examined are too pale and too large for *pandoo* and have wings, ♂ 120 to 125 mm. in length. It is not uncommon scattered here and there throughout N. Baluchistan.

Probably no Blue Rock-Thrush breeds in Central and Coastal Makran but it occurs sparingly in winter though I have seen no specimens.

Monticola saxatilis (L.) The Rock-Thrush.

The Rock-Thrush too is a summer visitor to N. Baluchistan and probably also a through migrant. Meinertzhagen found a nest on May 10 on Takatu 10,000 ft. and no doubt it breeds here and there on the higher hills such as Zarghun, Urak, Ziarat District whence specimens have been obtained in the breeding season, while St. John obtained it in the Amadun Valley in June. Some pass through the lower valleys in April and early May and on return passage in September ; it is at times very common in the Quetta Valley and hills near Chaman. At Ziarat I saw the last ones on September 25 when I met with a flock moving through the forest from tree-top to tree-top. In the Quetta Valley it occurs up to the end of October. Odd ones are said to winter but the evidence is not satisfactory.

In Central Makran I only know of it as a passage migrant. Hotson met with it several times in the valley of the Hinjol River in the middle of September. Baluchi birds are quite the same as European ones.

Myiophoneus horsfieldi temminckii (Vig.) The Himalayan Whistling Thrush.

The Whistling Thrush is practically resident and is only found in N. E. Baluchistan in hills of over 7,000 ft. Here wherever streams are perennial every secluded gorge has its pair ; hence it is very local and withal rather shy, so that it does not come much under notice unless its song is heard. Some at all events move down in winter as it has been found at that season at Kandahar in gardens and occasionally in the Cantonment at Quetta.

Prunella atrogularis (Brand.) The Black-throated Accentor.

This accentor visits the lower valleys of N. Baluchistan in winter in quite small numbers and all the records are from Quetta to Fort Sandeman. It does not arrive in Quetta till the end of November and the latest date is March 2. Radcliffe believes he saw it at Ziarat in the summer and there is a specimen thence in the Quetta Museum obtained on September 26 ; I saw none there at the end of September. Its breeding in Baluchistan remains to be proved.

Prunella strophiatus jerdoni (Brooks.) Jerdon's Accentor.

Watson records this accentor, and not the Black-throated, from Chaman and Saranan in January to March. No one else has met with it so perhaps there is some mistake. It however must breed as near our area as the Marwatin Valley in S. Waziristan whence there is a specimen in the Bombay Museum obtained on June 26, 1913. The *Fauna* (ed. ii, vol. ii, p. 197) includes Baluchistan in the breeding range of this bird but I know of no evidence of this.

Prunella fulvescens ocularis (Radde.) The Brown Accentor.

One obtained by Watson at Chaman in 1900 is in the Bombay Museum. This specimen the Museum authorities kindly sent to England for me to see and on comparing it I find it belongs, not to the typical race which occurs in Gilgit, Ladak, etc., but, as might be expected, to the form which occurs in N. Persia.

This is the only record in British Territory and is new to the Indian list.

(*To be continued*).

NOTES ON INDIAN BUTTERFLIES

BY

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(Continued from page 973, of Vol. XXIX)

43. The following additions and corrections are needed to the papers appearing in the Journal on the ‘ Identification of Indian Butterflies’ :—

A. 1. 4. α. *Add* locality ‘ Orissa ’.
A. 2. 9. β. *Add* locality ‘ Andamans ’.
A. 2. 10. γ. *Add* locality ‘ Andamans ’.
A. 2. 12. (13). Middle of line *for* ♀ *read* ♂.
A. 2. 14. *Add* locality ‘ S. Shan States ’.
A. 2. 16 (15). *For* ‘ red ’ *read* ‘ white ’.
A. 2. 18. β. *Add* locality ‘ Chin Hills ’. The butterfly has been obtained on Mount Victoria.
A. 3. 2. β. for ‘ *hypochra* ’ read ‘ *hypochroa* ’.
A. 4. 2. for ‘ *menon* ’ read ‘ *memnon* ’.
A. 4. 5. Alter ‘ *leococelis* ’ to ‘ *leucocelis* ’.
A. 4. 9. γ. Alter ‘ *ploycto*r ’ to ‘ *polyctor* ’.
A. 4. 10 β. *Add* locality ‘ Orissa ’.
A. 4. 17. *Alter* locality ‘ Karens ’ *to* ‘ S. Burma ’.
A. 4. 21. α. *Add* locality ‘ Orissa ’.
A. 4. 5. β. *Alter* locality ‘ Karens ’ *to* ‘ S. Burma ’.
A. 5. 5. *Alter* nymotypical name from ‘ *anticrates* ’ to ‘ *aristeus* ’.
A. 6. 7. *Alter* ‘ Shan States ’ *to* ‘ Assam ’.
A. 8. 1. β. *Insert* ‘ to Dawnas ’.
A. 8. 2. α. Alter ‘ *payani* ’ to ‘ *payeni* ’.
A. 8. 2. β. *Alter* ‘ Karens ’ *to* ‘ Dawnas ’.
A. 9. β. *Alter* ‘ Karens ’ *to* ‘ Ataran ’.
A. 13. 1. Alter ‘ *discobolus, Alph* ’ to ‘ *discobolus insignis, Stg* ’.
B. 3. In keys to genera and species alter ‘ *Synchloe* ’ to ‘ *Euchloe* ’. *Synchloe* is a synonym of *Pieris*, the generic type being *callidice*.
B. 8. In keys to genera and species alter ‘ *Anaphaeis* ’ to ‘ *Belenois* ’, which is the older name.
B. 1. Alter ‘ *xiphia* ’ wherever it occurs to ‘ *nina* ’, which is the older name.
B. 3. 3. *Add* locality ‘ Baluchistan ’. I have not ascertained whether it is true *daphalis* or the race *ausonia* that occurs in Baluchistan.
B. 4. 7. *Insert* at end :—

‘ γ. ♂ dark veining very pronounced. ♀ nearly black.
napi melaina, Verity. Chumbi Valley. NR.’

B. 4. 10. β. Alter ‘ *canidia canidia, Sparr* ’ to ‘ *canidia indica, nov.*’ As pointed out by Mr. Watkins *canidia* is referable to the larger Chinese race. Also *alter* ‘ N. Burma ’ *to* Dawnas’.
B. 5. 1. α. Alter ‘ *M* ’ to ‘ *Mar* ’.
B. 5. 2. β. Alter ‘ *Ersch* ’ to *Bdv*’.
B. 5. 3. Delete ‘ *larraldei* ’ which according to Watkins is not conspecific with *harrietæ*.
B. 4. 5. γ. *Alter* ‘ Assam ’ *to* ‘ S. Shan States.’
B. 6. 4 (5a). *Alter to* 4b (6a) and delete ‘ Black with——spots,’ after which insert :—

‘ 4(5). Unf no well defined sub-apical pale spots.
α. Upf whole of outer half white and on unh there are broad white streaks.
sanaca sanaca, M. (70-85). The Pale Jezabel. Kulu to Kumaon, *N.R.*
β. Much darker and smaller.
sanaca perspicua, Fruh. Sikkim to Dawnas. VR.
5(4). Unf with well defined small white spots. Above black with white spots ; variable.’

Under **B. 6.** 5.δ. Alter '*perspicua, Fruh*' to '*burmana, nov*' and *alter* 'Shan States' *to* 'Ataran'. Increase all subsequent numbers in the key by 1. I am indebted to Mr. Watkins for confirming an old suspicion of mine that *sanaca* and *belladonna* were separate species and also for pointing out that *perspicua,* which I have not seen is a *sanaca* form allied to the Chinese *subnubila.*

B. 6. 7. *Add* locality 'Nepal'.

B. 6. 8. α. *Insert* locality 'Vizagapatam'.

B. 6 8. β. *Alter* 'Sikkim' *to* 'Simla'.

B. 10. 1. *Alter* 'Karens' *to* 'S. Shan States'.

B. 10. 2. β. *Alter* 'alage' *to* 'lalage'.

B. 10. 6. α. I changed the name *venusta* to *norma* in B.N.H.S., xxix, 971, but my name should sink to *principalis, Fruh.*

B. 13. 1. *Insert* as the trivial name 'The Plain Sulphur'.

B. 15. 2 and 3. There is a growing consensus of opinion (Messrs. Riley, Watkins, Ormiston and Talbot) that *venata* is merely a seasonal form of *laeta.* Breeding experiments are required to establish the opinion.

B. 15. 4. Alter '*M*' to '*Wall*'.

B. 15. 5 (4.6). *alter* to 5a (4.7) and *insert* after it :—

'5 (6). Unf, apical area not entirely brown.'

After '*hecabe nicobariensis*' insert :—

'6 (5). Unf apical area entirely dark brown.
lacteola sarinoides, Fruh. (40–50). The Scarce Grass Yellow. Sikkim to S. Burma. VR.'

Alter 4 (5.6) *to* 4 (5a. 7) ; 6 (5.4) *to* 7 (5a. 4) ; 4b (7) *to* 4b (8) ; 7 (4b) *to* 8 (4b). The new species is the result of investigations by Riley and Watkins.

B. 15. 7. α. Alter '*rotundalis, M.*' to '*ormistoni, Watkins.*'

B. 15. 7. β. Alter '*andersoni*' to '*sodalis*', which name is prior.

B. 15. 7. γ. Alter '*Swin*' to '*M*'.

B. 16. 1b (3a). *Alter* to 4a and *insert* after it :—

'1 (2a). Upf no spot end cell. ♂ pale sulphur yellow with uniform broad black border. ♀ paler with yellow marginal spots.
marcopolo, GG. (42). Marcopolo's Clouded Yellow. Thui Nallah, Gilgit. VR.
2a (1). Upf always dark spot end cell.'

Alter 1a (7a) *to* 1a (8a) and subsequent numbers in genus to be increased by 1. *marcopolo* was obtained by Gen. Tytler's collectors.

B. 16. 4. Delete '*nastes*' ; *thrasibulus* has nothing to do with *nastes,* but may be conspecific with some C. Asian *Colias.*

B. 16. 10. *Alter* α and β *to* β and γ and *insert* :

'α. as β but smaller and not so brilliant. ♀ uph not so dark.
eogene shandura, nov. Chitral NR.'

and delete the locality 'Chitral' under β.

B. 16. *Add* at end of genus :

'Note. *phicomone phila, Fruh.,* was described in error from Kashmir.'

B. 17. 1. *Delete* the race *marianne nola,* which is only the extreme dry season form of *marianne* and may occur anywhere.

B. 17. 2. Alter '*pirenassa, Wall*' to '*satadra, M*' ; '*rhexia, F*' to '*pirenassa Wall*' ; '*moulmeinensis, M*' to '*meipona, GrS*'.

B. 17. 2. η. *Alter* 'Karens' *to* 'Dawnas'.

B. 20. 1. α. Alter '*aviatar*' to '*avatar*'.

B. 20. 2 and 3. I believe that *ceylanica* will turn out to be conspecific with *valeria,* but further evidence is necessary. They fly together in South India, and probably interbreed.

C. 2. 1*a* (8*a*). *Insert* 'usually' *after* 'v. 5'.

C. 2. 5. β. Alter '*Guer*' to '*Gray*'.

C. 2. 14. Alter '*alcippus, Cr.*' to '*alcippoides, M*'.

C. 3. 11. *Alter* 'Tavoy' *to* 'Ataran'.

C. 3. 14. *Insert* locality 'Manipur to S. Burma'.

D. 2. 8. *Alter* 'Tavoy' *to* 'Dawnas'.

D. 3. 6. *Alter* 'Sikkim' *to* 'Garhwal'.

D. 3. 9 and 10. I am not sure that I was correct in naming these 'species' ; they may turn out to be dry season forms of *vaivarta* and *sidonis.*

D. 3. 20 (21). *after* 21a (20) *should be altered to* 21 (22).

D. 3. 22. β. *Insert* 'to Dawnas' *after* 'Hills'.

D. 3. 29. *Insert after* locality '—S. Shan States'.

D. 3. 33. β. *Insert* '—Ruby Mines' *after* 'Nagas'.

D. 3. 37. β. *Insert after* locality '—Dawnas'.

D. 3. 38. *Insert* 'Ruby Mines'.

D. 3. 41. α. *Alter* first ♀ *to* ♂.

D. 3. 46. *Alter* 'Karens' *to* 'Dawnas'.

D. 3. 48. *Alter* 'Dusky' *to* 'Scarce'.

D. 3. 51. *Alter* 'Karens' *to* 'Dawnas'.

D. 3. 52. *Alter* 'N. Burma' *to* 'Dawnas'.

D. 4. 2*a* (1). *Alter* 'v2' *to* 'v4'.

D. 4. 2. *Insert* the locality 'Kurram'.

D. 7. 1. *Insert* the locality 'Lahoul'.

D. 7. 2. *Insert* the locality 'Kurram'.

D. 7. 8. β. *Insert* the locality 'Khyber'.

D. 8. 4(5a). Delete up to 5a(4); *alter* 5(6) to 4(5) and 6(5) to 5(4); add at end of genus:

'Note. *semele diffusa*, Butler, was described in error from India.'

D. 9. 1.α. Alter '*igna*' to '*digna*'.

D. 9. 2.γ. *Insert* the locality 'Baltistan, Ladak'.

D. 11. 1a(5) *Alter* to 1a(4).

D. 11. 2.α. *Insert* the locality 'Kurram'.

D. 13. 6. Alter '*M*' to '*But*'.

D. 13. 7. Mr. Watkins (A.M.N.H., 1925, page 233) has found that Moore's types of *annada* in the B.M. came from Bhutan and do not correspond with the familiar N.W. Himalayan insect which passes under the name of *annada*. He has also discovered that the name *suroia* must fall to *polyphemus*, which name was misapplied by Leech and Seitz to a large Chinese form, which Watkins has christened *oberthueri*. Whether true *annada*, true *polyphemus*, *orixa*, Mr. Watkins' *caeca* for the familar *annada* and his *watsoni* are conspecific, I cannot say; for the present I leave them as races of *annada* and make the following corrections: *alter* β and γ to γ and δ; after description to γ *insert*

'Unh white irrorations more striated.'

and after description to δ *insert:*

'Tornal ocelli obsolete. No male brand.'

Add the following new races:

'β. Unh tornal ocelli pupilled. Very like last.

annada annada, M. Nepal, Bhutan. VR.

η. Unh white irrorations reaching apex; dark bands sharply defined and traces of sub-basal fascia. Very like last.

annada watsoni, Watkins. (52-56). Chin Hills. R.'

Under α for '*annada annada, M*' read '*annada caeca, Watkins*' and *add* after description 'Tornal ocelli unpupilled'.

D. 13. 9. *Insert* the locality 'Sikkim.'

D. 14. 15. Alter '*Mar*' to '*M.*'

D. 14. 17. *Insert* the locality 'Manipur to S. Burma.'

D. 14. 19. *Alter* 'Karens' *to* 'Dawnas.'

D. 17. 1. *Insert* the locality 'Karens to S. Burma.'

D. 25. 1. Alter '*M*' to '*Butler.*'

D. 25. 8. β. *Alter* 'Karens' to 'Dawnas.'

D. 25. 9. *Insert* the locality 'Dawnas.'

D. 25. 12. γ. Alter '*Fruh*' to '*M.*'

E. 4. In key to genera and to species alter '*Stictopthalma*' to '*Sticopthalma.*'

E. 2. 3. *Insert* the locality 'Chin Hills.'

E. 4. β. *Insert* at end of description:

'Uph tawny colour surrounds the sagittate spots.

louisa fruhstorferi, Rob. N. Shan States. R.

γ. As last, but tawny colour clear of the sagittate spots.'

E. 5. 1. Alter '*Wd*' to '*Db.*'

E. 6. 1. *Alter* 'Karen Hills' *to* 'S. Burma.'

E. 7. α. *Insert* the locality '*Bassein.*'

E. 8. Alter '*Wd*' to '*Db.*'

E. 10. 1. Alter '*Fruh*' to '*Stich.*'

F. 24. In key to gener and to species alter ‘ *Liminitis* ’ to ‘ *Limenitis*.’

F. 1. 1. *Insert* after the description :
‘ α. Paler and uph pale margin very broad,’
and *add* the following race :
‘ β. Darker. Uph pale margin narrow.
durnfordi durnfordi, *Dist.* Tavoy to S. Burma. VR.’
Under α *Alter* ‘ S. Burma ’ *to* ‘ Dawnas.’

F. 1. 2. δ. *Alter* δ to η and *insert* the locality ‘ Andamans.’

F. 1. 6. *Insert* the locality ‘ Karens to S. Burma.’

F. 2. 5. Alter ‘ *jalysus, Fd* ’ to ‘ *jalysus ephebus*, *Fruh* and also *alter* ‘Begum’ *to* ‘ Nawab.’

F. 2. 6. *Insert* the locality ‘ Mergui.’

F. 2. 7. γ. Alter ‘ *Roth* ’ to ‘ *Fruh.*’

F. 2. 7. δ. *Alter* ‘ Karens ’ *to* ‘ Dawnas.’

F. 7. *Alter* 1a(6a) *to* 1a(7a) ; 1b(3a) *to* 1b(4a) and *insert* :
‘ 1(2a). Above tawny with black apical markings upf. Below as *sordida*.
cooperi, *Tytler*. (60-70). Cooper’s Emperor. N. Shan States, R.
2a(1). Above dark brown or greenish brown.’
Alter 1(2) and 2(1) *to* 2(3) and 3(2) ; *alter* 3a(1b) *to* 4a(1b) ; increase all remaining numbers in the genus by 1.

F. 7. 5. β. *Alter* ‘ Shan States ’ *to* ‘ Dawnas.’

F. 7. 8. γ. Alter ‘ *God* ’ to ‘ *Wd* ’ and insert the locality ‘ Orissa.’

F. 11. 1b. *Alter* ‘ Assam ’ *to* ‘ S. Shan States.’

F. 11. 2. Alter ‘ *mena* ’ to ‘ *nicévillei.*’ Mr. Watkins informs me that *mena* from Hong Kong is quite a different species and he also thinks that *jermyni*, *Druce*, which I have treated as a synonym is also a distinct species. The *Euripus* section of the Nyymphalidæ are very liable to freaking and I believe that *nicévillei* (caught once at Chamba) and *jermyni* (2 specimens caught together near Mussoorie) will prove to be freaks of *persimilis zella*.

F. 18. 9. α. *Insert* the locality ‘ Sikkim.’

F. 18. 22. Alter ‘ *Fd* ’ to ‘ *Tytler.*’

F. 18. 25. β. Alter ‘ *GrS* ’ to ‘ *M* ’ and ‘ Karens ’ to ‘ Dawnas.’

F. 18. 29. α. Alter ‘ *M* ’ to ‘ *Db and Wd.*’

F. 24. 2. *Alter* ‘ N. Burma ’ *to* ‘ Dawnas.’

F. 24. 4. Alter ‘ *M* ’ to ‘ *Db and Hew.*’

F. 24. 5. *Alter* ‘ N. Burma ’ *to* ‘ Shan States.’

F. 26. 6. Alter ‘ *kresna, M* ’ to ‘ *moorei, Fruh.*’

F. 25. 10. Alter ‘ *kresna* ’ to ‘ *karwara.*’

F. 26. 7a(5b). *Alter* ‘ unh ’ *to* ‘ unf ’ in the second line.

F. 26. 14. α. *Alter* ‘ Assam *to* N. Burma ’ *to* ‘ Sikkim to S. Shan States.’

F 26. 15. β. *Alter* ‘ Karens ’ *to* ‘ Dawnas.’

F. 26. 21. *Insert* the locality ‘ S. Shan States.’ One specimen was obtained by Capt. Drummond.

F. 26. 25. *Alter* ‘ Shan States ’ *to* ‘ Dawnas.’

F. 30. 2. In last line of description *alter* ‘ DSF ’ *to* ‘ WSF.’

F. 31. *Insert* locality the ‘ Andamans.’

F. 33. η. Alter ‘ *andamanica, M.*’ to ‘ *andamana, Fruh.*’

F. 35. 1b. Alter ‘ *oenone, Cr.*’ to ‘ *magna, nov.*’ Mr. Watkins informs me that *oenone* is referable to an African form.

F. 35. 5. Alter ‘ *Joh* ’ to ‘ *L.*’

F. 38. 1. *Alter* ‘ Kumaon ’ *to* ‘ Kulu.’

F. 39. 1. δ. Alter ‘ *Joh* ’ to ‘ *L.*’

F. 39. 2. α. Alter ‘ *M* ’ to ‘ *Koll.*’

F. 39. *Alter* 10b (13a) *to* 10b (14a) ; 10c (12) *to* 10c (13) ; 10 (11) *to* 10 (11a) ; 11 (10) *to* 11a (10) ; α *to* 11 (12) ; ‘ *gemmata mackinnoni* ’ to *eugenia mackinnoni* ’ : β *to* 12 (11) ; 12 (10c) *to* 13 (10c) 13a (10b) *to* 14a (10b) ; 13 (14) and 14 (13) *to* 14 (15) and 15 (14).

F. 40. 2b (4) *alter* to 2b (5) ; 2 (3) *to* 3 (4) inserting before it :
‘ 2 (3a). Below the bands, etc., are nearly obsolete. Above a somewhat fiery red with reduced markings.
saxatillis ferghana, *Stg.* (45). The Fiery Fritillary. Gilgit, Hunza. R.
3a (2). Unh and above strongly marked.’
Alter 3 (2) *to* 4 (3) and 4 (2b) *to* 5 (2b). This butterfly was found by Gen. Tytler’s collectors in the Gilgit area and by the Visser expedition in Hunza.

F. 45. 6. Alter ‘ *God* ’ to ‘ *Guer.*’

F. 50. 2. α. *Alter* ' Karens ' *to* ' N. Shan States.'

F. 52. Alter ' *Hub* ' to ' *Fab.*'

G. 3. 2. γ. *Insert* the locality ' Dawnas.'

G. 3. 4. *Alter* ' Karens ' *to* ' Dawnas.'

G. 3. 5. β. *Alter* ' Karens ' *to* ' Dawnas.'

G. 6. Alter ' *boulteri* ' to ' *boulleti.*'

H. Carry out following alterations in the Genera key. *Alter* 37b (94) *to* 37b (95) ; 37c (44a) *to* 37c (45a) ; 40b (43) *to* 40b (43a) ; 43 (40b) *to* 43a (40b) ; 43a (43b) *to* 43 (44) ; 43b (43a) *to* 44 (43) ; 44a (37c) *to* 45a (37c) ; 44 (45a) *to* 45 (46a) ; 45a (44) *to* 46a (45) 45b (81a) *to* 46b (83a) ; then increase by 1 all numbers up to 56a (50b) ; 56b (58a) *to* 57(b) (60a) ; 56 (57) *to* 57(c) (59) and delete.

' H 2 nearly equal tails at vs. 1 and 2 ' ; insert

' 57 (58). H lobe ill developed tail at v2 half as long as tail at v1.

Apharitis, Riley. The Silverlines.

58 (57). H lobe prominent ; tails at vs 1 and 2 nearly equal.'

Alter 57 (56) *to* 59 (57c) ; 58a (56b) *to* 60a (67b) ; then increase by 2 all numbers up to 64c (69e) ; *alter* 64d (66a) *to* 68a (67); delete 64 (65) and run on ; insert after ' *Charana* '.

'67a (66). ♂ with secondary sexual characters'.

Alter 65 (64) *to* 67 (68a) and add at the end of the description ♂ with a black area of modified scales about end cell upf.'

Then increase all numbers by 2 up to 80 (79) ; *alter* 81a (45b) *to* 83a (46b) ; then increase all numbers by 2 up to 89a (85c) ; *alter* 90 (91a) *to* 91 (92a) ; 91a (90) *to* 92a (91) ; 91 (92) *to* 92 (93) ; 92 (91) *to* 93 (92) ; 93 (85b) *to* 94 (87b); 94 (37b) *to* 95 (37b). *Alter* genera numbers in the Species keys and footnotes as altered in the Genera key.

H. 2. 6 *Insert* locality ' Dawnas '.

H. 6. 7. Alter ' *Fruh* ' to ' *M* '.

H. 17. 2. *Alter* ' N. Burma ' *to* ' S. Shan States '.

H. 20. 1. Alter ' *Fruh* ' to ' *Fd* '.

H. 20. 11b (18a) *alter* to 11b (19a) ; 11 (12a) *to* 11 (13a) ; 11a (11b) *to* 11 (12) ; 11b (11a) *to* 12 (11) ; increase all remaining numbers in genus by 1.

H. 20. 16. *Insert* locality ' Ceylon '.

H. 20. 17. γ. *Alter* ' *M* ' to ' *DeN* '.

H. 22. 2. β. *Insert* locality ' Kurram '.

H. 22. 4. Alter ' *F* ' to ' *Trimen* '.

H. 23. 1. Alter ' *Doh* ' to ' *Ob* '.

H. 25. *Alter* ' S. Shan States ' *to* ' Dawnas '.

H. 29. Alter ' Ramb ' *to* ' *L* '.

H. 30. 18. Commence new line from ' *ni* ' after ' *bhutea* '.

H. 31. 7 a (1a). *Alter* ' upf ' *to* ' unf '.

H. 31. 8. *Insert* locality ' Andamanas '.

H. 31. 10. Alter ' *lugine* ' to ' *cunilda* '. This alteration is made in accordance with Mr. Toxopeus' recommendation.

H. 34. *Alter* in both places *fusca* to *cymbia* ; Mr. Toxopeus informs me that *fusca* is a quite distinct species.

H. 35 6. *Alter* in both places ' *casyapa* ' to ' *caspius* '.

H. 36. 2 (3a) *alter* to 2b (4a) ; α *to* 2 (3) ; β *to* 3 (2) and delete ' *epicles* ' before ' *kohimensis* ', which Mr. Riley diagnoses as a distinct species.

H. 36. 3a (2) *alter* to 4a (2b) ; 3 (4a) *to* 4 (5a) ; substitute for the line ' *tamu*, etc.,' as follows :

> ' α. Upf dark border broad. 2 seasonal forms.
> *oda bakeri Riley.* (30-35). The Blue Saphire. Chitral to Kangra. NR.
> β. Upf dark border comparatively narrow.
> *oda oda, Hew.* Kangra to Kumaon. NR.'

Increase all remaining numbers in genus by 1. Mr. Riley has discovered that the type of *tamu* corresponds to the insect that passes under the name of *viridipunctata*.

H. 36. 6. Delete the second race and substitute :

> ' (*birmana, Fruh.*, was described in error and really = *marica* from Thibet).'

This change is due to Mr. Riley.

H. 36. 7. Alter *viridipunctata, DeN*, in all 3 places to *tamu, Koll.*

H. 42. 4 (3) *alter to* 4a (3) and *after* 'green' in the first line *insert* '4 (5)' commencing a new line. After '*ataxus zulla*,' etc., *insert* what now follows 10 (11), in order to put *letha* in its correct place, now that Capt. Drummond has discovered the ♀ in the S. Shan States, which locality should be inserted. *Alter* 5 (1a, 6a, 12a) *to* 6 (1a, 7a, 12a) ; 6a (1a, 5, 12a) *to* 7a (1a, 6, 12a) ; increase numbers up to 9a (5b) by 1 ; *alter* 9 (10a) *to* 10 (11) ; deleting 10 (11) *et seq* up to 11 (10) and running on from 'border' to 'Below' ; *alter* 12a (1a, 5, 6a) to 12a (1a, 6,7a).

H. 45. 1. Alter '*phaedrus*' to '*aesopus*' on the ground of priority. I have considerable doubt as to whether *aesopus* is not synonymous with *thetis* and that *saronis* is a race thereof.

H. 45. 5 (6). In the first line *add* 'or white' *after* 'orange' ; at end of the description following α add '♀ with white discal areas' and at end of description following β *add* '♀ with orange discal areas.' Orange females of this group do not, I believe, occur north of the Karens.

H. 50. 1a (72a) *alter to* 1a (73a) ; 1b (16a) *to* 1b (17a) ; 15 (13.14) *to* 15a (13.14) ; 15a (15b) *to* 15 (16) ; 15b (15a) *to* 16 (15) ; 16a (1b) *to* 17a (1b) ; increase by 1 all remaining numbers in the genus except that 72a (1a) becomes 73a (1a).

H. 50. 8. Insert '*aedias*' before '*opalina*.'

H. 50. 55. Alter '*Fd.*' to '*Stg.*'

H. 50. 68. Alter 'N. Burma' to 'N. Shan States.'

H. 50. 70a (67b). In third line of description *alter* 75 to 69.

H. 50. 72. α. Alter '*M*' to '*Hew.*'

H. 50. 76. β. Alter '*apidanus, Cr*' to '*kartaphilus, Fruh.*'

H. 50. 80. β. *Insert* 'and S' *after* 'N.'

H. 57. *Apharitis* now takes the place of H. 56. *Spindasis* ; delete (Plate 29), and in the second and third lines 'Above—orange' ; *alter* 1a (2a) *to* 1a (3) ; 1a (1b) *to* 1 (2) ; 1b (1a) to 2 (1) ; *hypargyros to hypargyrus* ; 2a (1a) *to* 3 (1a) ; and at the end of the description *insert*, running on, what now follows *after* 4 (5. 6a), deleting these numbers, so as to get *lilacinus* into its right place. After *lilacinus*, etc., *insert*,

> '**H. 58.** *Spindasis*. The Silverlines (Plate 29).
> Below as *Apharitis*. Above dark brown ; males usually blue or blue shot. Unf apical markings as in *lilacinus*.'

Alter 2b (14) *to* 1a (12) ; 2d (4a) *to* 1c (3a) ; 2 (3) *to* 1 (2) ; 3 (2) *to* 2 (1) ; 4a (2d) *to* 3a (1c) ; 4b (9) *to* 3b (7) ; 4 (5.6a) has been removed to *Apharitis* ; 5 (4.6a) *to* 3 (4a) ; 6a (4.5) *to* 4a (3) ; then decrease by 2 numbers up to 8 (7) ; *alter* 9 (4b) *to* 7 (3b) ; 10a (2c) *to* 8a (1b) ; then decrease by 2 numbers up to 13 (10b) ; *alter* 14 (2b) *to* 12 (1a).

H. 58. 7. *Alter* 'Karens' *to* 'Dawnas.'

H. 59. Alter '*Hew*' to '*Hub.*'

H. 61. 2. *Alter* 'Shan States' *to* 'Dawnas'.

H. 61. 3. α. Alter '*lucida argentea, Aur.*' to '*blanka sudica, nov.*' ; and under β alter '*lucida minturna, Fruh.*' to '*blanka argentea, Aur.*' Mr. Toxopeus has pointed out that *blanka DeN*, is the oldest name for this species and that *argentea* applies to the N. Indian form.

H. 61. 4. β. *Alter* 'Rangoon' *to* 'Dawnas'.

H. 61. 5. β. *Alter* 'Karens' *to* 'Dawnas'.

H. 61. 7. *Alter* 'N. Burma' *to* 'Dawnas'.

H. 62. Alter '*DeN.*' to '*M*'.

H. 64. *Insert* 'to S. Burma' *after* 'Assam'.

H. 65. 6. Alter '*oeeta*' to '*æta*'.

H. 65. β. *Alter* 'Karens' *to* 'Dawnas'.

H. 79. *Insert* 'Dawnas to' *before* 'S. Burma'.

H. 80. Insert '*marciana*' before '*miniata*', which I am convinced are conspecific and I hope shortly to define the Burmese races.

H. 85. 3. β. Alter '*Fruh*' to '*M*'.

H. 89. *Add* after description of genus :

'♂ brand uph always to base 6.'

Then *insert*

'1a (4). Unf discal band continuous.
1b (3). Unh no spot base 7.'

After 1 (2) *insert*.

'Unf discal band straight, prominent. Tuft dark brown.'

Delete the second '*isocrates*' and *add* after 'India' 'to N. Shan States,' For β substitute.

'2 (1). Unf discal band absent or faint.'

delete '*isocrates*', *add* '(40–44)' *after* 'Tytler' and *add* after 'Manipur' 'to N. Shan States. The Rosy Guava Blue. R.'

For 2 (1). substitute.

'3 (1b). Unh nearly always a spot base 7. Unf discal band elbowed; rarely a spot in the cell'.

Delete in lines 3 and 4 of the description 'discal band—to base 7.' Under β *delete* 'Unf very rarely spot in cell'.

For γ substitute.

'4 (1a). Unf discal band broken, lower part shifted in. Unh spot base 7 and usually spot in cell. Below paler, markings dark and prominent.'

Delete '*perse*' and *insert* before 'Andamans.'

'(48–52). The Scarce Guava Blue.'

Omit the 'N' before 'Burma' under 3. β. *perse perse.* I am convinced upon evidence produced by Mr. Cooper that *rosacea* and *smilis* are good species.

H. 90. 1a. (7a) *alter to* 1a (8a); 4b (6b) *to* 4b (7); 4 (5.6a) *to* 4 (5.6); 6a (4.5) *to* 6 (4.5); 6b (4b) *to* 7 (4b); 7a (1a) *to* 8a (1a) and increase by 1 all remaining numbers in the genus.

H. 90. 19. *Insert* after the description:

α. ♂ upf red area very wide, much wider than the basal and apical dark areas and not crossed by dark veins.

micans extensa nov. (32–34). The Red Himalayan Flash. Chitral. C.

β. ♂ upf red area narrower than the basal and apical dark areas and often crossed by dark veins.

Under β *alter* 'Chitral' *to* 'Kashmir'.

H. 90. 15. *Alter* 'Mussoorie' *to* 'Murree'.

H. 91. 1. *Insert* 'Bernardmyo' *after* 'Manipur'.

I. Genera key. 22 (20d) *insert* at end '(=*Entheus*, Ob).' 34 (35) insert 'and *Battus*' after '*Scelothrix*.' 95 (91b) *delete* '?' and *after* '=' *insert* '*Tanyptera*, Mab and ?'

I. I. 11. Insert 'and *tyrius*' after '*yanuna*.'

I. 15. After '*queda*, Pl' insert '*nibana*, Fruh'

I. 20. 7 and 11. *Delete* 'Clasp' at the end of the descriptions. I had furnished drawings of the clasps of these and other species, but the printers have been unable to reproduce them.

I. 24. 2. At end *after* 'Mab' *insert*: '*tenebrosa*, J and T, Hainan.'

I. 25. 4. *Insert* at end 'VR.'

I. 25. 5. *Insert* at end 'Sikkim to Assam. VR.'

I. 32. 2. Before '*pelias*, Fruh,' insert '*danae*, Pl'.

I. 71. 1. After '*prabha*,' insert '*vasuba*, *savara*'.

I. 74. 3 γ. *After* 'Java' *insert* 'Borneo'.

Correction *to* Plates.

I. *Alter* A. 2. 16 *to* A. 2. 17.

II.–V. No change.

VI. *Alter* A. 12. 1 *to* A. 11. 1.

VII. *Alter* B. 6. 4. 5 and 6 *to* B. 6. 5. 6 and 7.

VIII. *Alter* in title 8 and 9 *to* 9 and 11.

IX. *Alter* B. 15. 6 *to* B. 15. 7; B. 16. 5 *to* B. 16. 6.; B. 16. 6 *to* B. 16. 7.

X. No change.

XI. *Alter* D. 3. 46, 49, 50 and 51 *to* D. 3. 47, 50, 51 and 52.

XII. *Alter* D. 3. 16, 20, 22, 23, 27, 31, 35, 38, 39, 40, 44 and 45 *to* D. 3. 17, 21, 23, 24, 28, 32, 36, 39, 40, 41, 45 and 46

XIII. *Alter* D. 8. 6 *to* D. 8. 5. and in title *alter* 10 *to* 11 and *insert* before it '9. *Karanasa*; 10. *Paroeneis*;'.

XIV. No change.

XV. *Alter* D. 25. 10 and 11 *to* D. 25. 11 and 12.

XVI–XVII. No change.

XVIII. *Alter* F. 7. 4 and 7 *to* F. 7. 5 and 8. Add 1 *after* F. 11.

XIX. *Alter* F. 18. 15, 17 and 18 *to* F. 18. 14, 16 and 17.

XX. *Alter* F. 18. 19, 21, 22, 24, 27, 28, 30 and 31 *to* F. 18. 18, 20, 21, 23, 26, 29 and 30.

XXI. No change.

XXII. *Alter* F. 26. 29 and 32 *to* F. 26. 28 and 32.

XXIII. No change.

XXIV. *Alter* F. 39. 12 and 13 *to* F. 39. 13 and 14. ; also F. 40. 2, 3 and 7 *to* F. 40. 3, 4 and 5.

XXV. No change.

XXVI. *Alter* G. 4. 7 *to* G. 4. 6 ; H. 36. 5 *to* H. 36. 6 ; H. 42. 7 *to* H. 42. 8 ; in title alter '*Ilerda*' to '*Heliophorus*'.

XXVII. *Alter* H. 20. 14, 18 and 19 *to* H. 20. 15, 19 and 20 ; H. 44. 5 *to* H. 45. 5 ; H. 45. 1 *to* H. 46. 1 ; 47. 1 *to* 48. 1 ; 48. 1 and 2 *to* 49. 1 and 2 ; 94. 1 *to* 95. 1 ; also in title alter 44, 45–48 and 94 *to* 45. 46–49 and 95.

XXVIII. *Alter* 49 *to* 72 and advance all other numbers from 16 onwards by 1 ; also in title *alter* 49 *to* 50.

XXIX. First line increase all first or generic numbers by 1. Second line *alter* 56.2 *to* 58.1 ; 56.13 *to* 58.11 ; 57.2 *to* 59.1 ; 58.1 *to* 60.1 ; 59.1 *to* 61.2 ; and increase remaining first or generic numbers by 2.

Third and fourth lines increase all first or generic numbers by 2.

Fifth line *alter* 87.2 *to* 89.3 and increase all other first or generic numbers by 2.

Sixth line *alter* 88 *to* 90 in first four figures ; 88.12 *to* 90.13 ; 90, 91, 92 and 93 *to* 91, 92, 93 and 94.

In title *alter* 50–52 *to* 51–53 ; 53–55 *to* 54–56 ; 56–57 *to* 57–59 ; 58–63 *to* 60–65 ; 64–70 *to* 66–72 ; 71–78 *to* 73–80 ; 79–80 to 81–82 ; 81 *to* 83 ; 82–84 *to* 84–86 ; 86–93 *to* 87–94.

XXX–XXXII. No change.

Most of the changes in Burmese localities are due to Mr. G. E. R Cooper.

The following are new names :—

(*a*) B. and 10. '*indica.*' B. 6·4 '*burmana,*' B. 16.10. '*shandura*.' F. 35.1. '*magna,*' H. 61.3. '*sudica,*' H. 90.19. '*extensa,*' described by me.

(*b*) F. 7.1. '*cooperi*' described by Gen. Tytler in this number.

(*c*) H. 36.3. '*bakeri*' to be described by Mr. Riley.

AN ELEPHANT SHOOT ON THE BARAGUR HILLS (COIMBATORE DISTRICT)

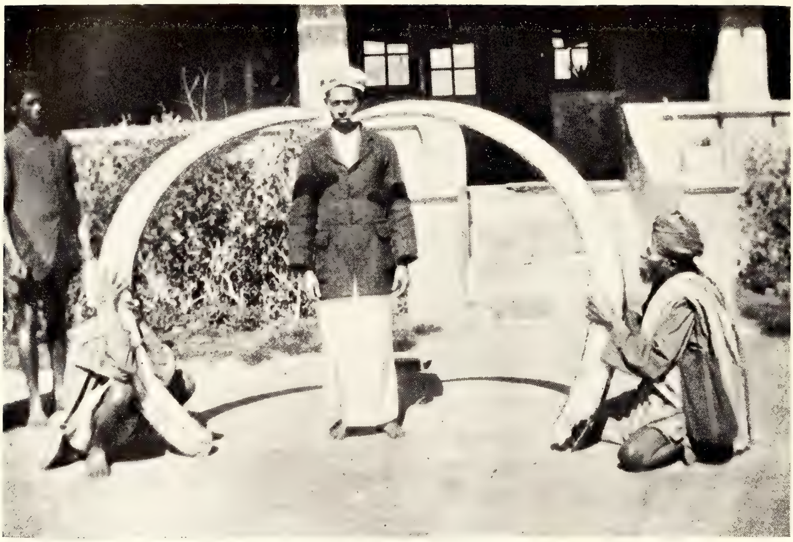
BY

RANDOLPH C. MORRIS

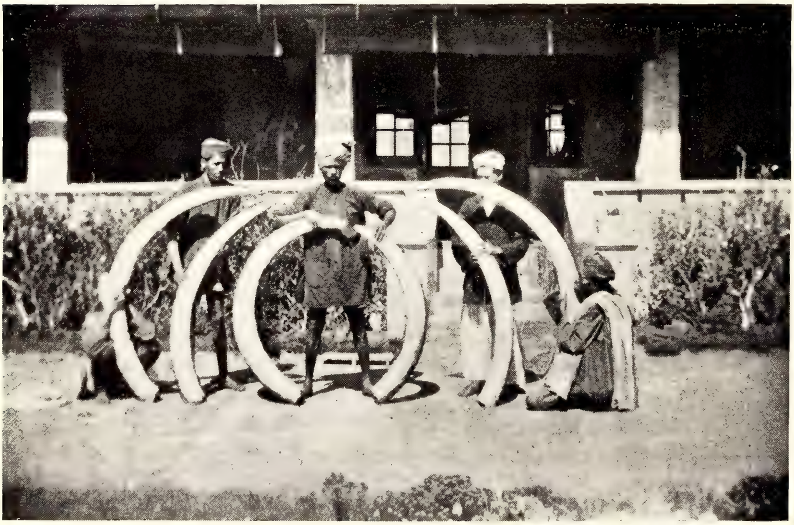
(*With a Plate*)

Three solitary tuskers having been proscribed on the Baragurs, the morning of February 28, 1926, found three of us, Major R. E. Wright, I.M.S., Mr. P. Saunders, (both of Madras), and myself at Hassanur (North Coimbatore) full of enthusiasm to go after the proscribed rogues. A delay occurred at Hassanur as the top two leaves of my Ford front springs had, we found, snapped, and new leaves had to be substituted which I luckily had with me (the roads round this part of the District being so vile I find it pays to carry nearly all the spare parts of a Ford with me !). We left Hassanur at 2 p.m. and travelled along sixty miles of a perfectly terrible ' road ' the last fifteen miles being across fields and along a cart track through the jungle, arriving eventually at the forest bungalow we had decided should be our first stop at 7 p.m. Here we were delighted to find our good servants (who had been sent on in advance) had prepared everything for our arrival, and we were not sorry to tumble into our cots after drinks and an early dinner. We were up before dawn, and having arranged for our kit to be brought along on pack bulls, we left after a meal at daylight for the second stage of our journey. Nine miles of track (even worse than the day before) took us to the foot of the northern end of the Baragurs ; leaving the car here in the bamboo jungle we ascended six miles of steep paved road-way that led from the foot of the hills to Madeswaran Mallai on which stands a famous and very sacred temple, pilgrimages to which, from the surrounding country-side, take place monthly. We had our trackers with us and we were more than pleased to arrive at a shady nalla about a mile from the temple itself, where we threw ourselves down for a well-earned rest. The climb had been a most exhausting one, the path being steep, the sun-blazing hot, and the paving stones hard. The shikaris went off to mark down the first elephant. We had arranged that Wright should take the first elephant we came across, Saunders the second and I the third. The bamboos were all in seed, and hundreds of jungle-fowl were feeding on the bamboo rice, and after a rest we amused ourselves stalking them. At about 5 p.m. the trackers returned with the news that they had marked down one of the three rogues, not half a mile from where we then were. We were not long in getting to the place where the men had seen the tusker and we found him with his back turned to us standing among some clumps of bamboos bordering a patch of open ground. We crept up to within about twenty yards of him : and he then got our wind (the wind was all over the place) and his trunk slowly came round, followed by his ponderous body until he faced us. That he spotted us was quite certain as he curled his trunk up and looked as if he meant business. Wright fired, supported by our rifles, which however were not necessary as Wright's shot aimed at the bump above the trunk, found its mark and the tusker collapsed stone dead. The tusks were very curved and massive, the left tusk being more than a foot shorter than the right. The elephant was a very old one and had not one single hair on the end of its tail. The right tusk measured 6 ft. 3 in. (weight 64 lbs.) and the left tusk 5 ft. (weight 54 lbs.). In quite a short time crowds of the inhabitants of Madeswaran Mallai (a village adjoining the temple) came to view the fallen elephant and rejoiced at its downfall, as for five or six years they had had a thin time of it with three rogues roaming through the jungle surrounding their village. Another elephant was reported to be in the vicinity but the light was too bad to make any move other than to the bungalow at Madeswaran Mallai. Needless to state we were very elated at our success that evening: everything had gone well so far and 'according to plan'. We left early next morning for the spot where we were told the second elephant was last seen, but there was no sign of him, he had evidently been scared off by the shooting. At about 10 a.m. however news came in that the elephant was at a place known as Kokkubarai, some six or seven miles away: and that the third tusker (a fellow with crossed tusks) was also there. This was great news and we travelled as fast as we could up hill and down dale over a rough and stony path and reached the shola which one of the elephants was said to be in, at noon. Sure enough, as we walked quietly along the path bordering the shola, Saunders taking the lead, the tusker came out on the path in front of us, and started to trek along the path, tail on. He soon left the path, and went off at a fair pace along the hillside, and we were hard put to it to keep him in sight. Eventually he slowed down somewhat, and we managed to get above him hoping for a side shot. This we found difficult for some time: and then came our chance. The elephant turned about and started to retrace his steps and then paused: Saunders got in an excellent ear-shot, supported by Wright, and the tusker rolled over dead with a tremendous crash. His tusks were a perfect pair, and each measured (and weighed) the same (length, 5 ft. 4 in.; weight, 35 lbs.). By this time we were fairly tired, and wished we could bag the third tusker without another long trek. Little did we realize then that our wishes were to be fulfilled. We were now about twelve miles from our camp and it was a broiling hot day. The third cross-tusked rogue was said to be a fiend, by far the worst of the three, and this was proved to be true. A man who had been sent to keep in touch with the tusker from a safe distance came back with the news that the tusker was standing in a small shola about two miles off. This was not so bad: we felt we could do another two miles anyhow! The elephant had gone along a path that skirted the hillside, and along this path we followed, my tracker Bomma in front carrying my rifle, I next, a local Lingayat third carrying Saunders' rifle, Saunders fourth, another tracker carrying Wright's rifle came fifth, and

Wright brought up the rear. We hadn't advanced more than a mile, and were just passing through a patch of infernally thick undergrowth, when Bomma, who had climbed a log that had fallen across the path, suddenly turned round, thrust the rifle into my hands with the word 'the elephant is coming,' and retired to the rear. I had visions of the rogue charging along the path and bursting in upon us while we were in the thick stuff, and realized our only chance was to get out of the patch by getting up above the path. To do this it was necessary to retreat a few yards, in my haste I forgot Saunders was close behind me, and turning round I knocked him off his feet ! I told him to get up and above the path as fast as he could, and hastening a few steps further, found myself clear of the thick patch and face to face with Wright who being last hadn't been able to take in the situation and couldn't understand why everybody was scattering. He had however seized hold of his rifle. 'Up above the path, quick' I whispered : and we both scrambled up through longish grass, keeping our eyes on the path expecting every second, to see the tusker appear. I saw Saunders had managed to get slightly higher than we were, and that he was endeavouring to climb up the side of a rock the top of which was flat and level with the hillside. It didn't occur to me then that Saunders had no rifle, and that only our two trackers were with us. The next moment a shrill trumpet rang in my ears, and looking up I saw the cross-tusked rogue bearing down upon us. As I looked he paused for a second, and I realized that I had to shoot quickly and shoot to kill. The elephant was within five yards of me and still closer to Saunders who however flung himself backwards into a crevice of the rock. I flung up my rifle, took quick aim at the bump above the trunk and fired and I heard Wright fire immediately after. The tusker pitched forward, the tips of its tusks about six feet from me, we both fired once more to make sure that he wouldn't rise again : but we need not have done so as the elephant was quite dead : both our bullets had entered its brain. It is hardly necessary for me to say that from first to last the whole affair took a mere fraction of the time it has taken me to write this. When we had sufficiently composed ourselves to take things in, we realized that Saunders was rifleless and that his rifle bearer was not on the spot. He was discovered some way off with Saunders' rifle still on his shoulder. He had bolted back with it directly he heard Bomma tell me the elephant was coming. I yelled to him to bring the rifle and never did I see a man more visibly ashamed of himself than he was when he rejoined us. The rifle was taken roughly from him by one of our trusty trackers and he was told to clear out in no uncertain terms. Saunders' feelings can be well imagined when he found himself without a rifle and the elephant literally almost on top of him : the elephant for a second had actually placed one of its feet on the rock Saunders was busily climbing ! We mounted the rock and Bomma pointed out the spot ahead of us where he had first seen the elephant. It was stationary and facing us when he caught sight of it, he said, and had started moving rapidly towards us, presumably on seeing Bomma. The spot indicated by Bomma, and verified by the other tracker was on an examination of the tracks,



MR. R. C. MORRIS'S TUSKER
R. 7′ 4½″ — weight, 63 lbs.
L. 7′ 7½″ — ,, 68 lbs.



THE TROPHIES

quite fifty yards from where it was shot, so that the elephant had covered this stretch in very quick time. The local fellow who had brought us news of the whereabouts of this tusker was very emphatic in his statements that he had last seen the tusker a mile further on. The Sholgas declared that our shooting had 'drawn' this rogue, and that it had retraced its steps. It was quite evident that the rogue had been getting our wind as we approached him (this was impossible to avoid as it was blowing in all directions), had paused, and then moved forward rapidly on seeing Bomma : but why not along the path we were then on ? It is my firm belief that the elephant, seeing Bomma disappear, had divined our intentions (or rather his intentions) and raced along the hill-side above the path to cut him off, and suddenly coming on a group of us made the pause fatal to him. That his pause was only momentary and he would have been among us the next moment is absolutely certain for we were altogether too close to him. The aftermath was all the more pleasurable in that the affair had been so full of incident and thrilling. The tusks were a splendid pair, the right one 7 ft. 7½ in. (weighing 68 lbs.) and the left 7 ft. 4½ in. (weighing 63 lbs.). There had certainly been a humorous side to the affair, our intense desire to escape from what we considered a death-trap having led us right under the feet of the elephant as it were. We were by now very weary and hot, and felt we could not face the trek back to our camp. We therefore walked back about four miles to a cool evergreen shola and decided to sleep the night there. We sent a man for our servants and kit; we still had our pack bulls in camp and rested till they turned up at about 10 p.m. It was very pleasant dining and sleeping on our cots that night on the open hillside just above the shola. We decided to end up our shoot by motoring southwards through the Baragurs to a place named Tattakerai where another rogue elephant had been proscribed, our intention being to have a go at this one also. We accordingly, next morning, sent off our kit and servants by a short-cut down to a forest bungalow at Geriki-Kandi, on the Kollegal-Bhavani road, and tramped down with our shikaris to our car. After mending a leak in the hose-pipe we started off and were once again motoring along dreadful tracks and bye-ways where no car had ever before been seen or heard of. A five-mile short-cut which we took across fields from one village to another in order to avoid an alternative route of fifteen miles was a positive nightmare: how the Ford Car stood it beats me and my respect for a Ford was increased a thousandfold on the completion of this journey. The track was good and bad in parts, and where it was bad it was generally 'orrid, the car having either to climb a series of outcrops of rock or dive into wash-outs and miniature gullies. The tyres were a mass of prickly-pear thorns and we were very soon mending puncture after puncture. On arriving at Geriki-Kandi where we intended to sleep the night we spent a hot and beastly hour or more mending inner tubes. We decided to push on to Tattakerai to make enquiries about the rogue and to return to Geriki-Kandi after doing this. We climbed seven miles of a steep and poisonous ghat and were glad to reach Tattakerai, which is situated on the summit of the Baragurs (4,000 ft.) and was comparatively cool, the heat at Geriki-Kandi being unbearable. The Forest Ranger had informed us that the rogue had not been heard of for three months, but on making further enquiries at a village named Oosimallai, a mile along the road from Tattakerai, we learned that the rogue visited the fields there nightly. This was cheering, and we left our trackers there, and motored back down the ghat to Geriki-Kandi. On our arrival we found our servants and kit had arrived, and we were very soon in our cots outside the bungalow. We left at 5 a.m. next morning, giving instructions for our kit to follow us, and arrived at Tattakerai at 6 a.m., and at Oosimallai a little later. Here we left the car and struck off into the jungle with our trackers and two local Sholagas. We did not have to go far before we come on fresh tracks of the elephant and a little later we heard him breaking bamboos. Two of our shikaris were sent to locate him: they unfortunately ' jumped ' a herd of bison which crashed into the jungle disturbing the elephant, and causing him to move off into some very thick stuff. On inspection we found that we would gain nothing by following him up into this cover, as it was far too dense. We then climbed a rock on the hillside overlooking the cover in the hopes of being able to locate the elephant. One of our trackers penetrated the cover below us for a short distance in order to climb a tree to get a better view, but with no better success. Soon after his return the elephant moved up to where this man had been, and evidently smelt him as he trumpeted shrilly and kicked the ground repeatedly. This showed that the elephant was inclined to be vicious, and we decided to throw in stones in the hopes of drawing him out. Our plan very nearly succeeded, as on hearing the first stone fall the rogue trumpeted again and charged to the spot where the stone fell. This went on for some time, our stones being hurled nearer and nearer to the edge of the cover. We got the elephant to within about ten yards of the edge of the cover, but nearer than this he would not come: he finally retired some way in, and would not move to stones and taps on trees, etc., so we decided to leave him in peace till the afternoon, in the hopes of his coming out to feed in more open jungle. In the meantime we discovered a way into the outskirts of the cover from down below, and took up our position in a favourable place and waited for him to come out: but this he would not do, and as the light was getting very bad, we decided to try to move him by the use of stones again. Stones were therefore hurled into the cover from above and only resulted in the elephant leaving the cover and that jungle in the opposite direction, with a scream. He evidently decided that the jungle was bewitched! We returned to the bungalow at Tattakerai and decided to have one more try for the rogue before closing our shoot. We left next morning for the same spot, hoping to find that the elephant had returned, and we sent two of our trackers in another direction. They soon marked down the rogue and if one of them had brought us word of this we would in all probability have added a fourth elephant to our bag, as they found him in very open jungle. They however stupidly sent a local Lingayat to fetch us, and the man for reasons known only to himself (probably after some heavy thinking) took us down into a deep and hot valley saying the elephant was making down the valley, instead of guiding us back to where our men were keeping in touch with the rogue. We walked up the valley for five or six miles, and when we reached the head of the valley and saw no signs of the elephant having been there at all we were considerably peeved. Even from here it took us quite another half hour to reach our trackers. This delay of nearly three hours lost us the tusker, as by the time we were on its tracks it had gone into thick cover. We cautiously followed it up, this being our last chance as we had to leave the next day. We finally caught a glimpse of the elephant's head half-turned towards us, giving only an eye-shot. This was taken, but either the elephant moved or the aim was not quite correct, the shot failed to bring him down and the elephant crashed off. We never saw him again although we followed him up for a considerable distance. We had to leave next morning, but we left one of our trackers, a good man, who, with a local, was to try and mark the elephant down as I hoped to return later to finish him off. We left at 7 a.m. motoring through the Baragur hills, through Baragur and Tamarakerai, and down the narrow ghat to the plains on the east, and back up to Hassanur, and so ended a most enjoyable and successful shoot : lasting a week and crammed with all the pleasures and thrills of the chase one could desire. We left the extraction of the tusks and the amputation and cleaning-out of the forefeet of the elephants to my two skinners who had experience of this before, and they did their job very well. The tracker left at Tattakerai to follow up the tusker returned several days later with the information that he could find no trace of the tusker, its tracks having got mixed up with those of a herd : and that he believed the elephant was going strong and none the worse for the knock it had received.

A NEW ICHNEUMON FLY OF THE GENUS *APANTELES* FROM THE DEATH'S HEAD MOTH *ACHERONTIA STYX*

BY

C. F. W. MUESEBECK

Of the Bureau of Entomology, United States Department of Agriculture.

WITH A NOTE ON ITS LIFE HISTORY

BY

C. McCANN

(*With a plate*)

Apanteles acherontiæ, new species

Female.—Length, 2·2 mm. Head, strongly transverse; temples, narrow; eyes, rather long and narrow; top of eyes, far below summit of vertex; malar space, slightly longer than the basal width of mandibles; face, weakly punctate; ocellocular line, three times as long as the diameter of an ocellus and decidedly longer than the postocellular line; antennæ, very nearly as long as the body, slender, all but the four or five apical segments of flagellum being distinctly more than twice as long as broad; mesoscutum punctate, very weakly so posteriorly; scutellum, moderately large, entirely impunctate and highly polished; propodeum, sculptureless, polished, without a median carina; mesopleura, smooth and polished, with a broad shallow impression posteriorly; posterior coxæ, smooth and shining; inner spur of hind tibiæ, not longer than half the hind metatarsus; forewings with the stigma, moderate; radius tending very slightly toward base of wing and not forming an angle with the intercubitus, but usually joining the latter in an almost even curve; abdomen, as long as the thorax, rather robust, broad; chitinized plate of first tergite broadening gradually from base to the apical third, from which point it narrows strongly to the apex, being slightly narrower at extreme apex than at base; this plate mostly polished, except on the apical third, where it is weakly punctate and opaque; the second tergite resembles that of many species of *Microplitis*; it is strongly transverse, polished and provided with two short, sharply impressed, posteriorly divergent grooves which set off a small triangular median area; the suturiform articulation is not straight, but tends a little posteriorly from the posterior ends of the oblique grooves to the lateral margins of the tergite and is very weak behind the median triangular area; third and following tergites polished; hypopygium not attaining apex of abdomen; ovipositor very short, scarcely projecting beyond apex of last dorsal segment. Black; scape and pedicel, yellowish-brown beneath; remainder of antennæ, brownish-black; all coxæ, black; basal segment of all trochanters more or less dusky; rest of legs, yellow; tegulæ and wing-bases, black; wings, hyaline; stigma, brown; veins, mostly very pale; abdomen, black.

Male.—Essentially as in the female.

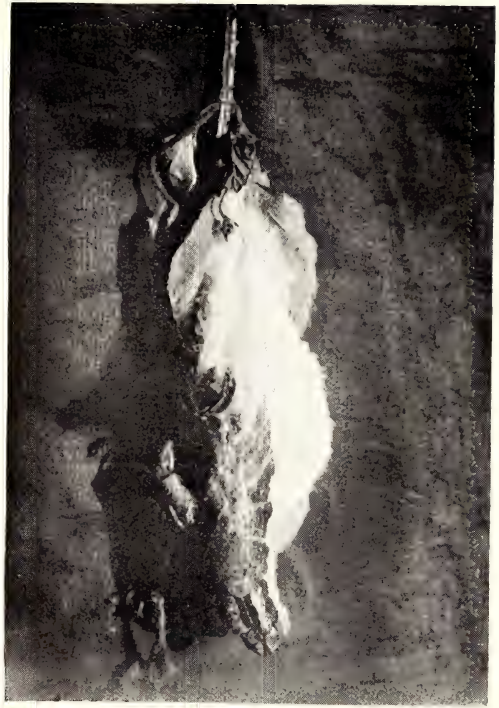
Cocoons.—Gregarious, surrounded by much loose white silk, giving the entire group the appearance of a large irregular cottony mass.

Type.—Cat No. 28989, U.S.N.M.

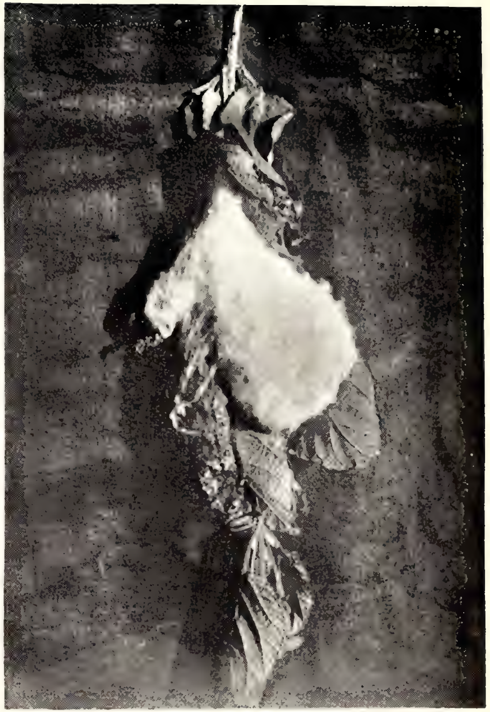
Type-locality.—Panchgani, W. Ghats, India.

Host.—*Acherontia styx.*

Described from 52 females and 1 male reared from a single host larva by C. McCann in October and November, 1925.



A. CATERPILLAR WITH ICHNEUMON COCOON ON UNDERSIDE, SUPPORTED BY A FEW STRANDS OF SILK



B. LATERAL VIEW OF A

LIFE HISTORY

Host.—The common host of this fly is the larva of *Acherontia styx* which feeds on *Lantana camera* and *Duranta ellisi.*

Emergence.—The eggs are probably laid at the end of September. The larvæ develop inside the host and emerge in October and the early part of November.

Locality.—Panchgani, Satara District, 4,300 feet.

Dissection.—The caterpillar on dissection revealed that the entire muscular system had been devoured leaving sufficient tissue in the feet for the caterpillar to hold on ; this in my opinion is the last part of the animal which is attacked. The nervous, respiratory and digestive systems were intact. A few larvæ were found still embedded in the muscle tissues of the feet.

The larvæ emerge from the body of the caterpillar at various points, either from the dorsal or ventral surface. In the former case the host is enveloped in silken thread from head to tail—in the latter the host lies above the cocoon which is held in position by a few strands of thread which are wound round its body. The cocoon is always situated near the head region of the caterpillar.

The body hanging, suspended head downwards, is the usual position of the caterpillar just before the larvæ leave the body. Very occasionally the host is able to free itself and move away leaving two or three cocoons behind it. Usually the caterpillar continues alive for 4 or 5 days after the emergence of the larvæ. At first it reacts to any stimulant all over the body, but gradually loses sensitiveness from the tail downwards and begins to shrivel till it dries up altogether, the drying process commencing at the tail and gradually working up to the head. During the drying process the caterpillar continually 'leaks' from the mouth, i.e., what moisture is in the body exudes from the mouth. The caterpillar hangs quite motionless and when touched by something moves in a lateral plane towards the spot of irritation. The movements are sudden and laboured. It is soon exhausted and returns to the pendant position. After the caterpillar is completely dry it breaks up and falls away leaving only the cocoon attached to the branch.

Cocoon.—The Ichneumon pupates in a common silken cocoon wherein each pupa is again enclosed in a separate silken case. There are 700 to 900 pupæ in each cocoon A notable point is that all the heads of the pupæ face the central point of the cocoon.

The imago will emerge together four to five days after pupation.

Larvæ.—The larvæ seem to come out at night. Some larvæ which were partially through the skin were forcibly extracted by me and exhibited a globule of some viscid matter which seems to be the substance with which the silk is formed, whether it is an excretion of the larvæ itself or matter from within the body of the host I am unable to say.

NOTES ON SMALL GAME SHOOTING IN THE KHASI HILLS

BY

EDWARD McCULLOCH

(*Continued from p. 445 of vol. xxx.*)

THE WOOD SNIPE (*Gallinago nemoricola*)

A few of these birds are generally shot each season but they do not appear to visit these hills in anything like large numbers. They appear to come later than the common Snipe as I don't remember to have seen them earlier than November. They apparently arrive about the same time as the wood-cock.

The Wood Snipe is a shy and solitary bird and is not to be found near human habitations nor in paddy fields. They frequent small marshy valleys, situated at the foot of small hills, or the small valleys that are to be found lying between two small hills. In such places they are generally to be found in clumps of tall ferns or small bushes and reeds growing on the borders. They then lie very close and seldom rise till almost trodden upon. When flushed however, they are very easy to shoot as their flight is heavy and owl-like. Even when fired at and missed they seldom fly far generally dropping well within 100 yards of where they were first put up.

A few of these birds are generally to be found in the early part of the season in the small marshes lying amongst the tumbled hills to the north of Dumpep (16 miles from Shillong). A few are also to be met with in favourable seasons in some of the small pieces of wet land at the foot of the Shillong Hill. Near Mairang or Pyndemumiong (30 miles from Shillong) they are to be seen in fair numbers in some years, and generally speaking this part of the locality appears to be the best for them. There are a large number of marshy plots and abandoned paddy fields overgrown with jungle near Mairang, and many of them would be found to hold one of these birds. They are of solitary habits, and two of them are seldom put up from the same piece of cover. Even when there are several birds in the neighbourhood, they are to be found each in its own patch of cover.

In December 1924 I devoted several days to searching for these birds but the largest bag made by me numbered only 4 birds in a day, and during five days I only shot 9 birds. In the middle of the month I made the bag of four birds on the road to Mairang and saw two more. One was slightly hit and could not be flushed again from amongst the tall ferns in which it had alighted. The other was not fired at as it rose far from where I was, one of the beaters having nearly trodden upon it while it was in a small hollow full of tall dry grass. It appeared to settle again in some bushes and reeds about 20 yards from where it rose but, do what we could, we failed to put up this bird also.

The other birds were shot, 3 of them in 2 days in the small marshes near Dumpep mentioned above, and the remaining two at the foot of the Shillong Hill in one day. Both were put up close to each other from the banks of a small stream which had marshy banks.

This species appears to be of more nocturnal habits than the Woodcock or the other Snipes, and when disturbed on a bright day with the sun shining, they appear to see with difficulty and will generally drop into the darkest hollow they can find. I have never seen one of these birds, settle on hill tops and other bare open places as Snipe sometimes do, and their flight is weak and without any of the twistings so beloved by the Snipe and which the Woodcock also sometimes indulge in. They are very good for the table and by some are considered to be the best of the Snipe tribe. This species appears to leave these hills earlier than other Snipes, as they are seldom seen later than March.

THE SOLITARY SNIPE (*Gallinago solitaria*)

A few Solitary Snipes may be met with in these hills in the season. They are however very scarce and I have never seen more than half a dozen of them in one year.

They frequent open marshy land and paddy fields, after the paddy has been cut, especially those in which there are a fair length of stubble, and are not partial to fields covered with long grass or other dense growths.

As the number of these birds visiting the Khasi Hills is very small (even in the most favourable seasons) it is not possible to make anything like a bag of this species alone though a few Solitary Snipes may be picked up along with other Snipes in the course of a season's shooting. The most likely ground for this species within easy reach of the Shillong Station is the stretch of marshy bits lying at the foot of the Shillong Hill on the right side of the Chateau Road and close to the motor shed erected by the Government. Here generally a bird or two may be found if there are any in the locality.

Some are also to be met with near Pyndemumiong or Mairang and I have also shot a bird or two in favourable seasons in the marshes lying to the north of Mawphlang.

In December 1922, I shot a couple of these birds in an extensive patch of marshy land covered with short grass situated some three miles to the north-east of the village of Langkyrdem (some 30 miles from Shillong) and was told by an intelligent beater that a few of these Snipes were regular visitors to the neighbourhood. As Langkyrdem is an unaccessible place, the road from Shillong being only suitable for pedestrians after passing Laitlyngkot (a stretch of some 13 or 14 miles) I have little doubt about the correctness of the man's statement regarding the presence of some birds of this species in the neighbourhood every year as they are not likely to be disturbed by any one.

As this part of the district was unvisited by European sportsmen owing to its inaccessibility, I had great hopes of making a record bag of Snipes of all kinds as well as Woodcock when I visited the locality as mentioned above, especially as there were some very likely grounds in the neighbourhood. The shooting was however comparatively poor, the Snipes were not at all numerous and few Woodcocks were to be met with.

The Solitary Snipe appear to arrive in the Khasi Hills in October or the last part of September and seem to leave earlier than other Snipes as they are rarely to be met with after February.

The Painted Snipe (*Rostratula benghalensis benghalensis*)

A rare visitor to these hills, a few occasionally straggling to the northern part of the Khasis in some seasons.

A few of these birds might be met with in the northern and warmer parts of these hills in favourable years, but they are rare enough for sportsmen who have had considerable experience of these parts failing to come across one of them during the whole of their career.

During some 20 years of shooting in these hills, I have record of only two authentic occurrences of these birds. The first, a female, was shot in the middle of October 1913 near Barapani on the Shillong-Gauhati Road, some eight or nine miles north of Shillong. This bird had apparently only very recently arrived as it was very thin and had been feeding when put up though it was then past midday of a warm bright day.

I might have met others of this species during the interval between, but am not sure and my next case is of the year 1922. In November 1922, I came across no less than three of these Snipes near Nayabangla or Umsning, some 18 miles to the north of Shillong, in the course of a three days' shooting trip.

Two were shot the same day and both were found to be males. The third which was put up on the last day of the shoot escaped as it could not be flushed again from where it had settled, the ground being very bad with deep muddy pools dotted here and there.

All three of them were put up from a fairly large morass covered with long grass and having a patch of open though muddy water in the middle. This self same ground was visited by me on other occasions prior to and after the shoot mentioned above, but on no other occasion did I come across any of this species.

They appear to be more nocturnal in their habits than any other of the Snipe tribe and lie very close, only rising when almost trodden upon and soon dropping within a short distance of where they were put up.

The Black-breasted Kalij (*Gennaeus horsfieldi horsfieldi*)

A fair sprinkling of these birds abound in suitable localities right through these hills. They are to be met with right on the borders of the plains as well as on the highest elevations, provided that the conditions of cover and food are suitable to them.

There are a fair number of these Pheasants in the Government Reserved Forests in the immediate vicinity of Shillong itself, and shooting in these Forests is open to permit holders on a yearly payment of Rs. 10. The permits are granted by the Deputy Commissioner, Khasi and Jaintia Hills, who is also in charge of the Government Forest Department of the district.

Two of the Reserved Forests, however, viz. (1) The Riat Khwan Reserve extending from near Mawlai (a northern suburb of Shillong) to Borpani or Khwan, nine miles from Shillong on the Shillong-Gauhati Road and (2) the Riat Labon Reserve about a couple of miles to the east of Shillong, are game sanctuaries and no shooting of any kind is allowed in them.

In these Reserved Forests a bag of a couple of braces might be made of a morning, provided the sportsman has a good dog or two with him, and is lucky enough to strike ravines holding a couple or more Kalij in each of them. This is however very greatly a question of chance as the birds are neither numerous nor tame. The largest number I ever obtained in one day in this locality was five, but this was a red letter day. Generally speaking, I used to be quite content if I got a brace in a day's shooting and considered myself in luck if I got anything above this figure.

Dogs, and good ones at that, are absolutely necessary in order to do anything with these pheasants. Without these it would be very little use going after the birds at all and the sportsman would almost be in the position of a man going fishing without hooks. With human beaters they will keep running ahead and soon get so far ahead, and into such broken ground, that it would be next to impossible for any human being to press them so closely as to make them rise. Even when in fairly open spaces, their powers of running make it practically impossible to flush them with human beaters. In such cases the sportsman's only chance would be to take a snap shot at one, as it flashes past under some patch of cover.

With dogs however, the case becomes quite different, the birds readily rise as soon as they are pressed by the dogs, and where they have not previously been disturbed fly into the nearest tree and become so engrossed with the dogs just below them that they hardly take any notice of the human beings. Under such conditions the sportsman will find no difficulty in getting quite close to the tree where they have settled and either potting them there and then or if more sportingly inclined turning them out of their refuge and taking them on the wing.

This Kalij loves deep ravines covered with dense bushes and other undergrowths and preferably having a small stream at the bottom. Though they visit the higher slopes and the neighbouring hill-tops in the mornings and sometimes in the evenings as well in quest of food, they do not stay long in such open places and retire as quickly as possible to the shelter of their beloved ravines.

The best time for shooting them is from January to March. At this time many of the ravines would be found to hold a brace or even more (especially when the sun is well up) and with a couple of good dogs, fair sport may be enjoyed.

A fair number of these pheasants also inhabit the precipitous cliffs on both sides of the Umiam River (a few miles to the west o

Shillong), but owing to the extremely bad and broken ground on which they are found and the dense bushes and other thickets with which these cliffs are covered, it is impossible to make anything like a bag, though a bird or two may often be picked up when the sportsman is after Barking Deer or Thar.

Some of these pheasants are to be met with early in the mornings and late in the evenings along the Shillong-Gauhati Road from about Umran (22 miles from Shillong) right up to Khanapara, seven miles from Gauhati, where the forests terminate. They come out to the road in the mornings and evenings in order to pick up grains, etc., from cattle droppings, and cart sidings for bullock carts are favourite places. Though no big bags can be made, owing to the difficulty of getting at the birds once they get off the road into the thick jungles on both sides, a brace or two may be picked up if the sportsman go for them early enough, i.e. before the lorries and other motor cars have driven them off into the jungle, and again in the evening just a little before darkness sets in. The best bit of the road for this shooting is between Barnihat (47 miles from Shillong) and Khanapara. Here when in luck not only a brace or so of this species but a red jungle fowl or two and also a few pigeons may be picked up of a morning. The road between Nongpoh (33 miles from Shillong) and Umling (about 41 miles from Shillong) is also another good stretch as it is very lonely and unfrequented.

There are a few of these pheasants in the Lyngdoh Forest at Mawphlang, and the Forests near Mairang or Pyndemumiong also hold a sprinkling of them, but owing to their being constantly harassed by the natives they are anything but numerous.

This pheasant is not hard to kill and as they are generally shot at close ranges, owing to the nature of the coverts they affect and their habit of only rising when closely pressed, number four shot will be found most suitable for them. In places where the birds have become very wild however, number two might be used with advantage. A 12-bore gun is best for this sport and small bores are not so satisfactory.

This is quite a fair bird for the table, though the old cocks require hanging up for a day or so.

INDIAN DRAGONFLIES

BY

LT.-COL. F. C. FRASER, I.M.S., F.E.S.

Part XXV

With 1 Plate and 5 Text-figures

(*Continued from page 426 of Vol. XXXI*)

Genus—MACROGOMPHUS, Selys.

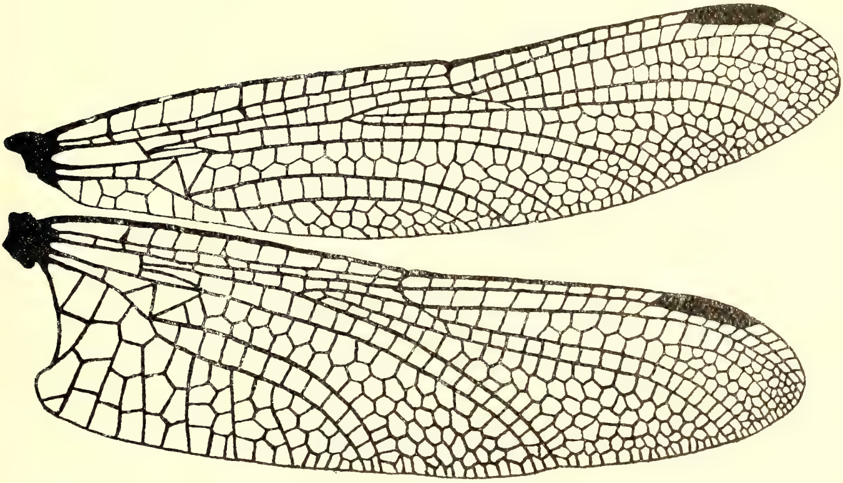


Fig. 1. Wings of *Macrogomphus seductus*, sp. nov., male.

Macrogomphus (Sely), (*Heterogomphus* pars), Bull. Acad. Belg., xxi (2), p. 27 (1854) ; id. Mon. Gomph., pp. 87, 428 (1857); id. Bull. Acad. Belg., vii, p. 334 (1859) ; id. ibid. (2), xlvi, p. 413 (1878) ; Will. Proc. U.S. Nat. Hist. Mus., xxiii, pp. 273 and 287 (1907) ; Laid. Rec. Ind. Mus., p. 375 (1922).

Arboreal Gomphines of large size, coloured glossy black with brightly contrasted yellow markings. Wings hyaline, reticulation close, base of hindwing of male deeply excavate, tornus prominent ; arc opposite, or a little distad of the 2nd antenodal nervure ; 2 rows of postanal cells in forewing 4 and 5 in the hind, where the 1st postanal cell is entire and extends basad only a little beyond the centre of base of subtrigone ; a basal incomplete antenodal nervure present in all wings ; the 1st and the 5th or 6th the primary antenodals ; 4 and 5 traversing nervures between *Mi-iii* and *Miv* in forewing, 4 in the hind ; all trigones, hypertrigones and subtrigones entire ; 3 rows of cells between *Mi* and *Mia* at level of outer end of pterostigma ; pterostigma small, barely equal to one-fourth the distance from node to outer end of pterostigma, braced ; *Cuii* pectinate in forewing ; *Cui* and *Cuii* in hindwing parallel as far as termen ; 2 rows of discoidal cells in forewing nearly to level of node ; 2 cubital nervures in forewing as a rule, only 1 in the hind ; sectors of arc parallel at origin, then divergent ; costal and basal sides of trigone in forewing sub-equal and both shorter than distal side ;

costal side of trigone of hindwing considerably longer than the basal and considerably shorter than the distal ; anal triangle 3-celled

Head moderately large, wide transversely ; frons strongly angulate ; occiput simple as a rule. Thorax robust ; legs short, armed with 2 rows of minute closely-set pines ; armature of mid and anterior femora scarcely differing, that of female similar, but spines more widely-spaced and fewer. Abdomen tumid at base, segments 3 and 6 thin and cylindrical. 7 and 8 moderately dilated, the 8th at least double the width of 6, segment 9 narrow and tapering, *nearly twice the length of 8, 10 very short and small.* Anal appendages of male longer than segment 10, the superiors with a long, fine, inner branch springing from about its middle. The inferior deeply cleft, its long branches as widely divaricate as the superiors and more or less sinuous. Genitalia prominent, lamina strongly arched, rather depressed ; anterior hamules short and spatulate ; posteriors robust, flattened, projecting markedly, furnished with an outer apical or subapical spine ; lobe scrotal-shaped, bluntly bifid. Vulvar scale variable, small, tapering and bifid at apex, or cleft as far as base into two small triangular processes.

Larva highly specialized, especially as regards the terminal abdominal segments (which are reflected in the imago). Head small and triangular, face pointed ; abdomen very long and cylindrical, the end segments greatly elongated and produced into a siphon-like structure. This curious tubular organ projects from the mud or sand whilst the rest of the body is submerged, and thus enables the insect to carry on rectal breathing without exposing its body. As one would surmise, the end segments are relatively longer in the earlier instars than in the adult stage.

Distribution. *Macrogomphus annulatus* is confined to Western India in the drier zones of the Deccan, whilst *M. wynaadicus* takes its place in the wetter montane areas. *Macrogomphus montanus*, *robustus*, and *seductus* (a new species described below) are from North India and Thibet. None so far have been reported from Burma and Ceylon, but *M. parallelogramma* (Burm.), *albardae* Selys *decemlineatus* Selys, *quadratus* Selys, *thoracicus* M'Lach., and *abnormis* Selys are found in Java, Sumatra, Tonkin, Borneo and the Malay Peninsula.

The habits of *annulatus* and *wynaadicus* have been studied by the present author. The imago emerges in a horizontal plane whilst the larva rests on rocks and stones in midstream. In spite of this, the long abdomen and wings reach full development unimpared. As soon as the wings are sufficiently dried, the imago sets off directly inland until it reaches higher ground, where it comes to rest high up in trees. It may thus be found a mile or more away from its parent stream, in the Deccan, where trees are few and far between. In the heavily wooded country of the Western Ghats, the insect at once rises to the tops of the tallest forest giants and may there be picked out with the aid of field-glasses, at heights of 100 ft. or more.

Pairing takes place in such retreats, the males never being seen in the neighbourhood of water, except at emergence.

As pointed out by Williamson, species of the genus fall into two well-defined groups, characterized by the close reticulation and greater curving of the main nervures at their distal ends, in the one group, and by the simpler reticulation and straighter nervures in the other, to which latter group, all Indian species belong.

Genotype—*Macrogomphus annulatus*, Selys.

Macrogomphus annulatus (Selys) (*Heterogomphus annulatus*) Bull. Acad. Belg., xxi, (2) p. 28 (1854) ; id. (*Macrogomphus annulatus*), Mon. Gomph., pp. 92,405, (1857) ; id. Bull. Acad. Belg. (2) xxviii, p.170 (1869) ; id. ibid. (2) xlvi, p. 414 (1878) ; Will. l.c., pp. 289, 290 (1912) ; Laid. l. c., p. 376 (1922) ; Fras. Rec. Ind. Mus., vol. xxvi, pp. 470, 471 (1924).

Male. Abdomen 45 mm Hindwing 35 mm.

Head black marked with citron yellow as follows :—The lateral lobes of labium, bases of mandibles, two very large transversely oval spots on labrum, large spot on each side of the postclypeus against the eye connected narrowly along the lower border of postclypeus, the upper surface of frons except at its extreme base and a small median point of black projecting into the yellow. Lastly an obscure spot on the vertex. Occiput straight, slightly raised, its border fringed with black hairs.

Prothorax black marked with a small spot of yellow on either side and a narrow anterior collar.

Thorax black marked with citron yellow as follows :—2 thick wedge-shaped antehumeral dorsal stripes, tapering to a point above, broadly confluent with a

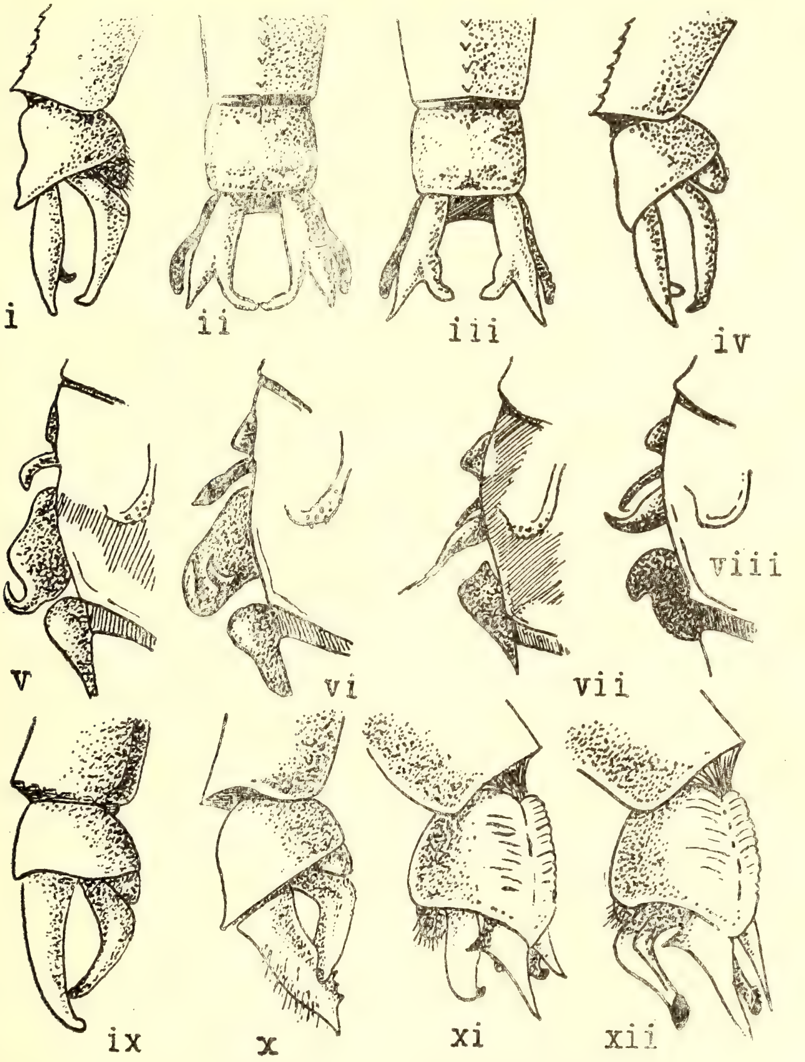


Fig. 2.—*Macrogomphus annulatus.*

i. Anal appendages of *Macrogomphus annulatus*, Selys, seen from the side. ii. The same dorsal view. iii. The same of *Macrogomphus seductus*, sp. nov. iv. The same seen in profile. v. Genitalia of *Macrogomphus annulatus*, Selys. vi. The same of *Macrogomphus seductus*, sp. nov vii. The same *Acrogomphus fraseri*, Laid. viii. The same of *Perissogomphus stevensi*, Laid. ix. Anal appendages of *Acrogomphus fraseri*, Laid. x. The same of *Perissogomphus stevensi*, Laid. xi. The same of *Anormogomphus kiritschenkoi*, Bart., dorso-lateral view. xii. The same of *Anormogomphus heteropterus*, Selys.

narrow, interrupted mesothoracic collar below, the inner border of these stripes parallel, the outer divergent below. The middle of ante-alar sinus narrowly yellow, the sides very broadly so and marked by a broad medial oblique black stripe which is bifid below to enclose a spot of yellow.

Legs black, coxæ and trochanters with a large yellow spot.

Wings hyaline, with a pale yellow ray in the cubital space. Nodal index $\frac{9\text{–}16 \mid 16\text{–}11}{10\text{–}11 \mid 11\text{–}10}$; *2 cubital nervures in all wings*; pterosigma dark brownish black.

Abdomen black marked with citron yellow as follows :—segment 1 with the sides and dorsum broadly, 2 with a lanceolate dorsal bilobed stripe, the oreillets broadly and a latero-basal stripe, segments 3 to 6 with broad basal complete rings equal to nearly one-fourth the length of segments, 7 with its basal half yellow on dorsum, rather more than this laterally, 8 and 9 with a baso-lateral triangular spot.

Anal appendages. Superiors yellow, the inner border, branch and extreme apex rusty brown, broad at base, cylindrical and tapering to a fine point in the apical third, prior to which the inner branch is given off. The latter fine, directed obliquely in and back, the apical third bent abruptly inward and slightly flattened. Inferior appendage black, broadly split into two branches which are so wide apart at the base as to appear as two separate appendages, very sinuous, curling first in, then out and again in at the apex. Of the same length as superiors, narrow and rather irregular.

Genitalia. Lamina forming a gothic arch, prominent, coated with straight hairs; anterior hamules moderately long, sinuous, pointed at apex as seen in profile, spatulate as seen from below; posterior hamules very robust, broad, sloping back and projecting markedly. The extreme apex ending in a fine curled spine directed forward and in. (Text-figure 2, *v.*). Lobe scrotal-shaped, black, corrugated, deeply bifid into two conical nipple-like processes.

Female. Abdomen 49 mm. Hindwing 38 mm.

Differs in but few respects from the male, as follows :—The yellow markings more extensive, the stripe on frons broader, the spot on vertex is large and conspicuous, lying just in front of occiput. The thorax nearly always bears an upper humeral spot (rarely present in the male), and there are nearly always two spots on the lateral black band. The pterostigma is slightly longer, the nodal index higher $\frac{11\text{–}17 \mid 18\text{–}9}{11\text{–}14 \mid 12\text{–}10}$; the occiput bears a bifid or trifid tubercle on its hinder border, occasionally separated as 2 or 3 robust spines; segment 9 is longer than in the male, whereas 10 is shorter. Vulvar scale glossy black, short, broad at base, tapering to a blunt point, bifid at apex but the two branches closely apposed.

Distribution. The Deccan bordering on the Western Ghats. The type (British Museum) probably came from Poona or Satara where I found the species quite common during September and October. It breeds in the Moolah River and from thence extends inland for long distances, nearly every acacia tree harbouring one or two specimens. Paratypes in the Morton, Laidlaw and my own collections.

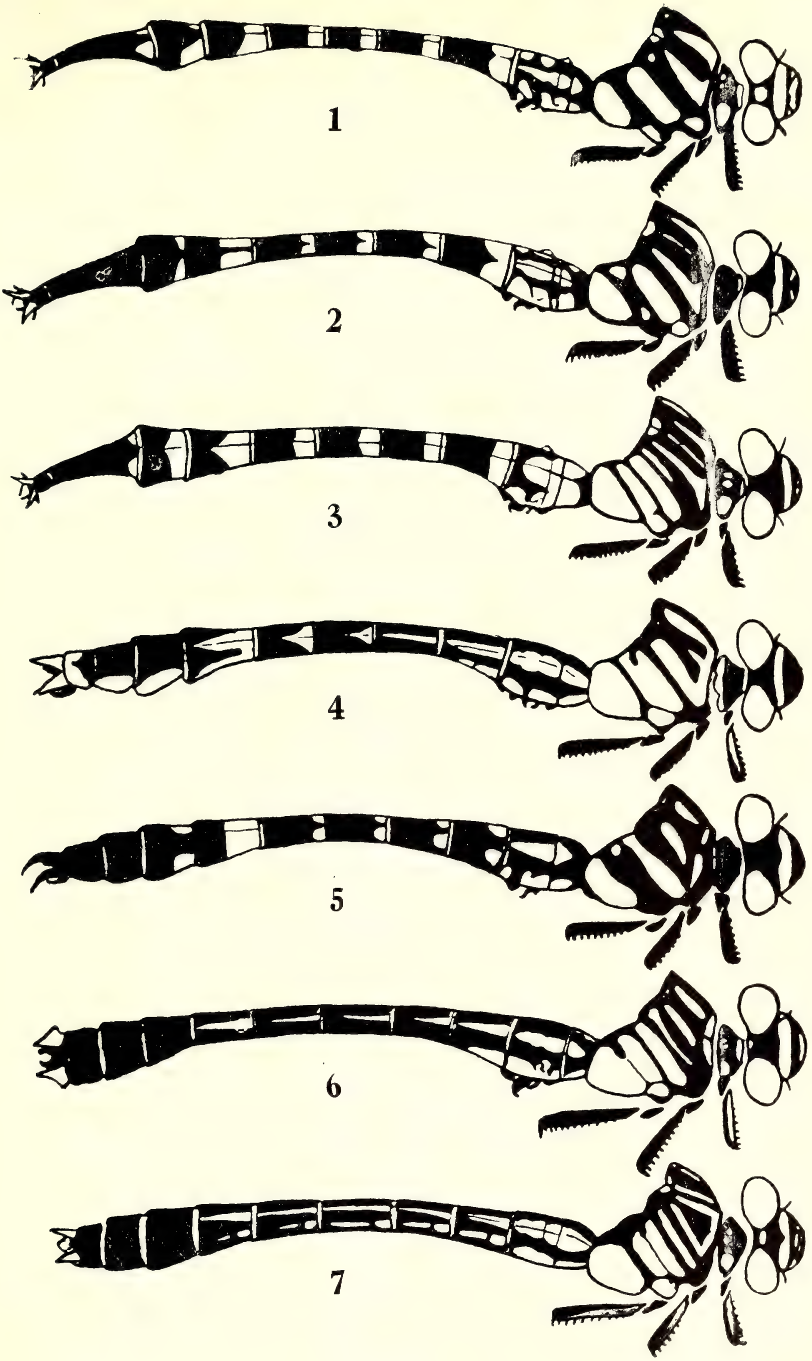
Macrogomphus wynaadicus, Fras., l.c. pp. 471, 472 (1924).

Female. Abdomen 53 mm. Hindwing 45 mm.

Closely related to *annulatus*, of which it may be a subspecies modified by the influence of a jungly habitat and a humid climate. It is a larger species and differs in a large number of minor details from *annulatus*, as follows :—

The yellow spots on labrum are almost obsolete; the face entirely black save for a small spot at each end of the postclypeus; the occiput is a little emarginate and without any vestige of the spines found in *annulatus*, a dark brown line bordering its front replaces the conspicuous yellow spot seen in that insect. Prothorax entirely black. Thorax very similar but without any humeral marking, the lateral black line, on the contrary, is marked with a medial yellow interrupted line.

Wings, in the type, rather darkly and evenly enfumed, but this may be mere evidence of old age; reticulation closer than in *annulatus*, the pterostigma covers 6-7 cells instead of only 4, and the nodal index is higher $\frac{14\text{–}20 \mid 20\text{–}14}{13\text{–}15 \mid 14\text{–}13}$; 2 cubital nervures in all wings. Abdomen differing more markedly by having



1. Dorso-lateral view of *Macrogomphus annulatus*, Selys, male
2. The same of *Macrogomphus seductus*, sp. nov., male.
3. The same of *Macrogomphus montanus*, Selys, male.
4. The same of *Perissogomphus stevensi*, Laid, male.
5. The same of *Acrogomphus fraseri*, Laid., male.
6. The same of *Leptogomphus gestroi*, Selys, male.
7. The same of *Leptogomphus inclitus*, Selys, male.

(Figures 1, 2, 4, 5 and 6 drawn from specimens in the Fraser collection, figure 3 from a specimen in the Indian Museum collection, whilst figure 7 has been constructed from the Selysian description.)

paired spots instead of complete rings. Segment 2 has the dorsal stripe broadly broken at its centre, 3 with a large baso-lateral dorsal spot widely separated from its fellow by the black dorsal carina, 4 to 6 similar but the spots smaller, 7 has the yellow basal half split by a black dorsal carina as far as its base Segment 10 is longer and narrower than in *annulatus*.

Vulvar scale shorter, with convex hinder border, not bifid.

Distribution. Nilgiri Wynaad, Coorg and Western Ghats from North Kanara to Malabar. A rare insect although the larvæ and exuvia may be found abundantly in any stream throughout the area. I have only once seen the male, this particular specimen being perched on a tree overhanging the Mercara Sidapur Ghat Road. I wounded it with a charge of dust-shot but it managed to plane down into a thorny thicket, where although I could see it plainly, I was quite unable to reach it. I have seen vast numbers of exuvia on rocks in the Kibribetta stream, North Coorg, but never an imago was to be seen in the neighbourhood. Type in my own collection.

Macrogomphus robustus (Selys), (*Heterogomphus robustus*), Bull. Acad. Belg., xxi, (2), p. 27, (1854); Id. Mon. Gomph., pp. 88, 89 (1857); Id. Bull, Acad. Belg., xlvi (2), p. 414 (1878); Will. l.c., p. 289 (1912); Laid. l.c., pp. 375, 376 (1922).

Male. Abdomen (missing but by analogy with other species,—) about 45 mm. Hindwing 42 mm.

Head black, frons depressed, not notched, forming a very obtuse angle in front, marked with an orange stripe in front of ocelli; a blackish spot at side of mandibles; ocelli and lower lip partly brown; an obscure brown spot on clypeus; occiput not scale-like but with a large raised bifid tubercle at its middle, hairy in front and behind.

Prothorax black with a basal ring and a lateral spot yellow.

Thorax black, with 6 orange stripes, the two in front cuneiform, separated from each other, broader towards the mesothoracic notch which they do not quite reach and their apex not quite reaching the alar sinus; the two lateral, slightly oval, situated under each wing. A yellow spot at middle of antealar sinus and a large dorsal band of same on interalar space.

Legs entirely black. Abdomen missing.

Wings moderately broad, tinted with yellow ochre, especially towards the base; reticulation black; pterostigma brown, a little yellowish, moderately broad, 4 to 5 mm. long, over 6 cells, between black nervures, its end terminating in a paler line; anal border very excavate; membrane black, very slender but extending as far as anal angle; 19 antenodal nervures in forewings, 14 in the hind, 13 postnodal nervures in all wings. Female unknown.

Distribution. Thibet. A single, incomplete male in the Selysian collection. The species is distinguished by the labium entirely black; by the bifid tubercle on the occiput and lastly by its high nodal index. The latter character has induced me to separate it from *seductus*, a new species described below, to which also belongs the two males and single female in the Indian Museum placed by Laidlaw and Selys as *robustus*. The shape of the occiput also serves to separate it from *seductus* in which latter it is simple. The nodal index in *robustus* is $\frac{13\text{-}19}{13\text{-}?}\Big|\frac{19\text{-}13}{?\text{-}13}$, compared to $\frac{12\text{-}15}{10\text{-}10}\Big|\frac{14\text{-}10}{11\text{-}10}$ in *seductus*.

Macrogomphus seductus, sp. nov.

Male. Abdomen 50 mm. Hindwing 40 mm.

Head, labium black; labrum glossy black with two transversely elongate basal greenish yellow spots; anteclypeus black, postclypeus black, but its lower border and a large spot on either side against the eyes greenish yellow; frons black in front, broadly yellow above, where its base only is finely black; vertex and occiput black, the latter simple, neither spined nor tuberculated, fringed with long black hairs behind.

Prothorax black marked with a narrow anterior yellow collar.

Thorax black marked with citron yellow as follows:—Antehumeral stripes tapering to a fine point above at the alar sinus, very broadly confluent below with a slightly interrupted mesothoracic collar.

No humeral marking. Laterally the sides broadly yellow and marked by a broad medial oblique black band, which is itself marked by an upper small spot and a lower large spot.

Legs entirely black but trochanters and coxæ marked with yellow.

Wings palely saffronated, more deeply so at bases, especially in the cubital space Pterostigma black (dark brown by transmitted light), over 5 to 6 cells, braced ; nodal index $\frac{12-15 \mid 14-10}{10-10 \mid 11-10}$; membrane brown ; anal triangle 3-celled.

Abdomen black marked with citron yellow as follows :—Segment 1 with its apical half, the basal black encroaching on this subdorsally, where is a well-marked ridge resembling a second rudimentary oreillet bearing a fringe of long hairs, segment 2 almost entirely yellow, a broad basal ring, the oreillets except for a fine blackish brown bordering, and its sides broadly. The black on this segment is restricted to a broad subdorsal band ending basad abruptly at the jugal suture. Segments 3 to 6 with broad basal rings slightly notched by the black dorsal carina and covering nearly one-third of segment 3, one-fourth of 4 and rather less of 5 and 6, segment 7 with the basal half yellow, whilst 8 has an irregular baso-lateral stripe, segments 9 and 10 unmarked.

Anal appendages rather longer than segment 10. Superiors pale yellow, the apices carneous, as also the inner branch, which arises at middle of appendage is much shorter and stouter than in *annulatus* (only about half the length), and does not extend to apex of appendage. At the base of appendage is a long fine ventral spine. Inferior appendage glossy black, widely cleft, broad at base as viewed from below, tapering to a point. Branches sinuously curved as seen in profile, but not to the extent found in *annulatus*, divaricate, the extreme apices turned up rather abruptly.

Genitalia. Lamina narrow, more prominent than in *annulatus*, deeply and roundly arched ; anterior hamules spatulate, narrow at base, broadening apicad, convergent ; posterior hamules very robust, flattened, bluntly pointed at the apex where there is a pencil of long fine hairs. Subapicad is a small recurved spine ; lobe similar to *annulatus*.

Female. Abdomen 56 mm. Hindwing 44 mm.

Very similar to the male. Occiput slightly concave, simple. Prothorax black with three tiny obscure spots on the posterior lobe in addition to the anterior collar. Thorax and legs not differing from the male. Wings enfumed saffronation only evident at the bases ; nodal index $\frac{12-19 \mid 18-12}{11-12 \mid 13-11}$; 2 cubital nervures in all wings ; the 1st and 6th the primary antenodals ; pterostigma black, over 5 to 6 cells. Abdomen similar to the male but the subdorsal black fascia on segment 2 confluent over dorsum, and the dorsal carina on segments 4 to 7, especially 6 and 7 black, the basal rings being split into basal paired spots.

Anal appendages creamy yellow, very short, conical.

Vulvar scale very short, glossy black, bifid as far as its base into two small but broad triangular processes.

Distribution. Hasimara, Duars, Bengal. A single pair in my own collection (the male the type), taken by Mr. H. V. O'Donel. Two males and a female in the Indian Museum, the former two doubtfully referred to *robustus* by Laidlaw, the latter labelled *robustus* by De Selys himself. It is to be noted that Selys never described the female of *robustus* however, and mentions it as unknown. The differences between *robustus* and *seductus* have already been pointed out under the description of the former. From *montanus* it is easily distinguished by the total absence of a humeral stripe, etc. The Indian Museum specimens come from Sibsagar, Assam.

Macrogomphus montanus, Selys, Bull. Acad. Belg. (2), xxviii, p. 171 (1869) ; Will. l.c., p. 289 (1912) ; Laid. l. c., p. 377 (1922).

Male. Abdomen 50 mm. Hindwing 38 to 40 mm.

Head black marked with yellow as follows :—Two rather large oval basal spots on labrum ; labium yellowish ; the lower border of postclypeus, a stripe on the upper border of frons. Occiput brown, its border raised into a small conical tubercle at the middle.

Prothorax black, unmarked.

Thorax black marked with antehumeral stripes similar to those of *seductus*, but rather longer and wider (roughly these marks may be compared to the outline of a tintack with its head below). In addition there is a narrow humeral stripe gradually tapering away to a fine point below. The sides of thorax broadly yellow the two lateral sutures being finely mapped out in black, Wings hyaline, palely enfumed, reticulation close, brown ; pterostigma dark brown, over **5** to 6 cells ; nodal index $\frac{12\text{–}18 \mid 20\text{–}11}{10\text{–}11 \mid 12\text{–}11}$.

Legs dark blackish brown.

Abdomen black marked with yellow as follows :—Segment 1 almost entirely yellow, 2 with a basal ring confluent with a dorsal stripe and a broad spot on the oreillets, 3 to 6 with basal rings as in *annulatus* but longer and occupying about one-third of the segments. On segments 3 and 4 these rings prolonged along the dorsum shortly, segment 7 with the basal half yellow and also prolonged along the dorsum, segment 9 with a small baso-lateral spot.

Anal appendages very similar to those of *annulatus*, thick at base, divaricate, tapering to a point in the apical half. The inner branch springs from the middle of appendage, slopes downwards and inwards, is black in colour, its apex bevelled to a point and extending a little beyond apices of superior appendages. Inferior appendage black, nearly as long as superiors, widely and deeply forked, branches more divaricate than superiors.

Female. Abdomen 47 mm. Hindwing 40 mm.

Very similar to the male, differs by the yellow markings rather more extensive. Wings tinted with yellow at base and along costal margin ; pterostigma pale brown ; nodal index slightly higher.

Occiput yellow, its border bicrenulate and with a tubercle situated behind, similar to, but larger than that of male. (This tubercle is not visible from the front.)

Segment 2 has the dorsal stripe broader and bilobate, the rings on the other segments distinctly broader. Anal appendages yellow, conical, very tiny and inconspicuous. Vulvar scale similar to *seductus*.

Legs dark reddish brown, tibiæ on the outer side, and also the hind femora, reddish brown.

Distribution. Sylhet. Type in Selysian collection. A pair in the Indian Museum determined by Selys, but without data as to locality.

This species is at once distinguished from all other Indian forms by the presence of a humeral stripe and the sides of thorax marked with two fine black lines instead of the thick medial black stripe.

Genus—ACROGOMPHUS, Laidlaw

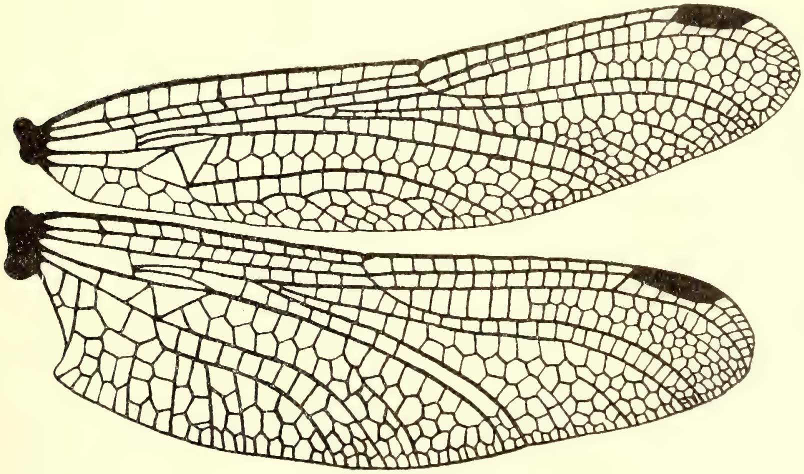


Fig. 3. Wings of *Acrogomphus fraseri*, Laid., male.

Acrogomphus Laid., Proc. Zool. Soc., Part 2, pp. 439, 440 (1925).

A genus of moderately large arboreal Gomphines coloured black with brightly contrasted but restricted yellow markings. Wings hyaline or tinted at the base with yellow; reticulation close; base of hindwing of male oblique but rather deeply excavate, tornus prominent; arc lies between 1st and 2nd, or between 2nd and 3rd antenodal nervures; sectors of arc parallel at, and for a short distance after origin, then divergent; 1 or 2 rows of postanal cells in forewing, 3 to 4 in the hind, the 1st postanal cell in latter entire or divided, and extending inward to well proximad of the inner end of base of subtrigone, forming a distinct anal loop in the genotype; no basal incomplete antenodal nervures; the 1st and the 5th or 6th the primary antenodal nervures; 3 to 5 cross nervures between *Mi-iii* and *Miv* in forewing, 2 to 3 in the hind; all trigones, subtrigones and hypertrigones entire; 1 to 2 rows of cells between *Mi* and *Mia* at level of distal end of pterostigma, which is equal to about one-fourth the length of distance from node to outer end of pterostigma, braced; *Cuii* markedly pectinate in forewing; *Cui* and *Cuii* parallel in hindwing as far as termen; 2 rows of discoidal cells in forewing to beyond level of node in the male, to well short of node in the female; 1 cubital nervure in forewings, 1 or 2 in the hind; trigones with distal side longer than costal and costal longer than basal in forewings, trigone in hindwing more elongate than in fore; anal triangle 4-celled.

Head large, face deep, frons forming a slightly obtuse angle with face; occiput simple. Thorax robust; legs rather short, hind femora extending only to base of segment 1. All femora with a field of robust, short, closely-set spines on the flexor surface, lengthening distad and less numerous on the middle and anterior femora.

Abdomen tumid at base, thin and cylindrical from segment 3 to middle of 7, then widening again to the end, segments 8 and 9 with distinct lateral leaf-like prolongations.

Genitalia variable in the species. Lamina narrow, arched, prominent; anterior hamules moderately long narrow processes with a recurved hook at apex; posterior hamules more robust, broad at base, tapering to a fine point, sloping back; lobe of penis moderately large and prominent, scoop-shaped.

Anal appendage variable in the species, superiors simple, long, curved and tapering; inferior deeply cleft, branches slightly divaricate. Vulvar scale short, deeply incised.

Distribution. India and Malaysia.

Geno-type. *A. fraseri*, Laid.

Acrogomphus fraseri, Laid. l.c., 11·441–443 (1925).

Male. Abdomen 44 mm. Hindwing 38 mm.

Head: labium variegated with shades of brown; labrum black with a semilunar spot, greenish yellow, on either side of middle line; bases of mandibles, anteclypeus, the upper part of frons and a slight overlapping of its crest yellow. Base of frons above, vertex and occiput black, the latter simple, emarginate and with a minute notch at its centre.

Prothorax black, unmarked.

Thorax black marked with bright citron yllow as follows:—A narrow interrupted mesothoracic collar, a pair of wedge-shaped antehumeral stripes not extending as far up as the alar sinus, and falling well short of the mesothoracic collar below, squared above, pointed and divergent below. Laterally a broad stripe on the mesoepimeron, the posterior three-fourths of the metepimeron, and a small spot of yellow above and between them.

Legs black, the inner surfaces of anterior femora bright yellow, a small spot of the same colour at the middle of the outer side of mid femora and a larger spot on the hinder femora.

Wings palely saffronated throughout, this deepening gradually to a golden yellow near the bases. Nodal index variable $\frac{11\text{–}18 \mid 18\text{–}11}{12\text{–}12 \mid 12\text{–}11}$ $\frac{11\text{–}16 \mid 16\text{–}12}{12\text{–}12 \mid 12\text{–}12}$, $\frac{9\text{–}15 \mid 16\text{–}8}{10\text{–}11 \mid 11\text{–}9}$; pterostigma black, braced, over 5 cells; 1 cubital nervure in all wings; anal loop well-developed, formed of 2 cells and extending proximad nearly to level of cubital nervure; discoidal field in forewing of 2 rows of cells to beyond level of node; membrane black.

Abdomen black marked with bright citron yellow as follows :—Segment I with a triangular dorsal spot, its base resting on apical border of segment, laterally a large spot, segment 2 with a linear middorsal stripe slightly expanded basad, and two spots on each side, one of which includes the large oreillet, the other apical, segments 3 to 6 each with a pair of subdorsal basal spots decreasing in size from 3 to 6, segment 3 has also a small middorsal subbasal spot. Segment 7 with the basal half yellow, the yellow invaded by the black dorsal carina behind and in front, and separated narrowly from the base of segment by a narrow basal black ring. Segment 8 with a subbasal spot on each side, and 9 with a similar but much smaller (occasionally absent in some specimens).

Anal appendages black. Superiors dark reddish brown, almost black, broad at base, tapering to a fine point, curved down at apices and regularly curved inwards towards each other as seen from above so as to enclose a fusiform space very similar to what is found in *Onychogomphus circularis*, Selys. Inferior cleft into two branches almost as far as its base. Viewed laterally this appendage slopes sharply down in its basal third, then recurves sharply upwards as a rounded right angle. Branches of even width except the extreme apex which thins rather abruptly. From below the branches are divaricate, broad at base, tapering rapidly to a blunt point, which turns out slightly at the apex.

Genitalia. Lamina small, prominent, arched as a large segment of a small circle ; anterior hamules thin, moderately long, directed back, and in the apices ending in a small needle-like point which turns abruptly outwards ; posterior hamules somewhat similar in shape but larger and more robust, sinuous, ending in a point which is directed back and in ; lobe scoop-shaped, prominent, black.

Female. Abdomen 43 mm. Hindwing 40 mm.

Very similar to the male, the wings broader, rather less saffronated than in the male, the abdomen broader, stouter, cylindrical throughout.

Markings a little broader, the two spots on the sides of segment 2 confluent to form a complete lateral stripe ; the carinal spot on 3 larger ; the lateral spots on 8 and 9 absent ; the labium pale brown ; occiput similar to male but there is a large conical spine at each end, situated well back of the inner corner of eyes. Spines on femora fewer, more widely spaced and more robust. Nodal index :—

$\frac{12\text{–}21}{14\text{–}15}\Big|\frac{18\text{–}12}{15\text{–}13}$, $\frac{13\text{–}18}{14\text{–}14}\Big|\frac{19\text{–}14}{14\text{–}14}$, $\frac{12\text{–}21}{13\text{–}15}\Big|\frac{20\text{–}12}{15\text{–}14}$; 1 cubital nervure in forewing, 1 to 2 in hind.

Vulvar scale extends less than half the length of segment 9, bifid almost to base, its two branches divaricate, separated by a broad rounded notch, the branches broadly and bluntly triangular.

Distribution. Coorg, at altitudes of 3,000 ft. Type in the Laidlaw collection, paratypes in the Morton and my own collections. Only 3 pairs of this rare and beautiful insect are known but possibly its rareness is due to its habit of roosting at great heights, often as much as a hundred feet or more above the ground. I have watched females ovipositing in the Sampaji stream, generally in tunnels formed by cane brakes arching and covering over the stream. They drop their eggs in clean water where the current is swift and the bottom sandy or gravely. At such spots they hover about one inch above the surface of the stream, glide forward for a few feet, reverse rapidly in their own length and return. This manœuvre is repeated again and again, a hovering pause taking place before each turn to give time for a fresh batch of eggs to be extruded. With each glide, the insect dips and strokes the eggs off on the water's surface. Females are occasionally seen crossing open glades, flying low and trailing the abdomen as if it were fractured. With the aid of field-glasses males could be seen at times perched on prominent dead twigs on the tops of trees, or soaring at great heights in company with *Orogomphus campioni* and *Zygonyx iris*. In appearance, this species greatly resembles *Onychogomphus circularis* Selys, the anal appendages especially being a close copy of those of that insect. Dr. Laidlaw conjectures that *circularis* may be found to belong to genus *Acrogomphus*. The type has been damaged, but recently another specimen has come into my hands, and I am now able to confirm it as an *Onychogomphus*.

Genus—PERISSOGOMPHUS, Laidlaw.

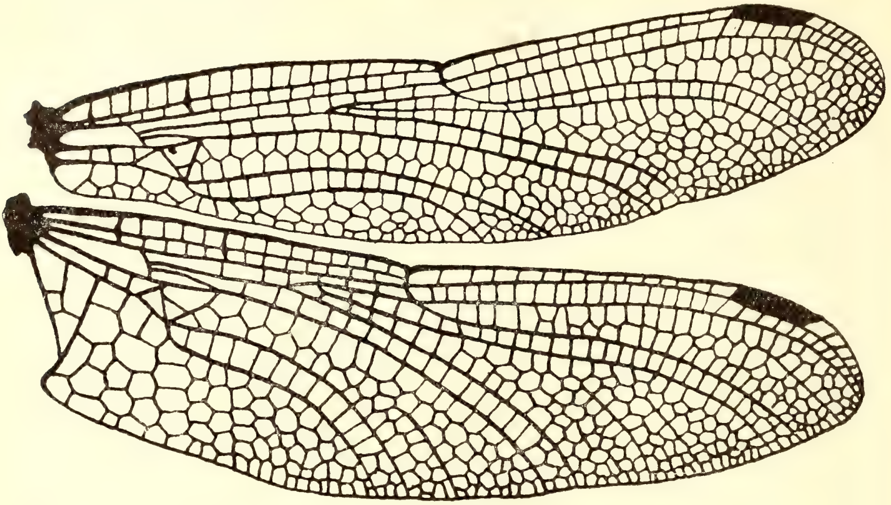


Fig. 4. Wings of *Perissogomphus stevensi*, Laid., ♂.

Perissogomphus, Laid., Rec. Ind. Mus., vol. xxiv, pp. 383, 384 (1922) ; Fras, ibid., p. 418 (1922).

A monotypic genus, the only known species of which is of moderately large and robust build, coloured black marked with grass-green. Wings hyaline, reticulation very close and redundant ; base of hindwing in the male oblique but moderately deeply excavate and tornus well angulated. Arc between the 2nd and 3rd antenodal nervures ; sectors of arc approximated immediately after origin, then slightly divergent ; the 1st and 6th or 7th the primary antenodal nervures ; 2 to 3 cubital nervures in forewings, 2 in the hind ; 4 cells in anal triangle ; 2 rows of postanal cells in forewing, 5 in the hind where the 1st cell is divided into 2 or 3 cells so as to form a distinct anal loop as in *Ophiogomphus*, which extends basad to well proximad of the inner end of base of subtrigone ; no basal incomplete antenodal nervure ; *Cui* in forewing markedly pectinate ; *Cui* and *Cuii* in hindwing divergent towards termen, 5 cells between their ends ; 2 rows of discoidal cells in forewing to a little beyond level of node; 1 to 2 rows of cells between *Mi* and *Mia* at level of outer end of pterostigma ; pterostigma small, less than one-fourth the length of distance between node and distal end of pterostigma, swollen, braced, over 4 to 5 cells ; 4 nervures between *Mi-iii* and *Miv* in forewing, 2 in the hind ; *Miii* and *Miv* distinctly sinuous ; trigones entire or traversed (One ma e has the trigone of left forewing and both in the hindwings traversed, another has only those of the hind traversed, whilst others have all entire ; two females have the trigones of forewings only traversed, another has the trigone of left forewing and both in the hind, whilst five others have those of hindwings alone traversed) ; subtrigones and hyper-trigones entire ; trigone of forewing with its sides subequilateral, the outer side a little angulate ; trigone of hindwing longer, with distal side longer than costal and costal longer than basal. (When trigones are traversed, the traversing nervure runs from basal to distal side.)

Head moderately large, frons rounded, face oblique ; occiput simple, hinde border straight, fringed with long black hairs, a small tubercle on its dorsum which bears a tiny longitudinal sulcus. Similar in the female but the tubercle smaller, rounded and without the sulcus. Thorax robust. Legs moderately long and robust, extending to apical border of segment 1 ; hind femora with 2 rows of short robust closely-set spines ending distad in a field of smaller spines. Mid and anterior femora very similar but without the field of spines and those forming the two rows smaller and less numerous. In the female, the spines more robust, longer and less numerous.

Abdomen tumid at base, thin and cylindrical from segment 3 to 7, where the segments gradually dilate as far as 10. Segments 8 and 9, and apical half of 7 with distinct lateral narrow foliations.

Anal appendages closely similar to those of genus *Gomphus*, both superiors and the branches of inferior divaricate.

Genitalia prominent; lamina narrowly and deeply arched, projecting prominently; anterior hamules long narrow hooks ending in a long fine backwardly curved spine; posterior hamules thick at base, robust, ending in a sharply curved, forwardly directed spine; lobe pitcher-shaped with its rim strongly emarginate.

Vulvar scale very short, very broad, its free border presenting two widely divaricate minute triangular processes.

Distribution. Assam, Bengal and Sikhim.

Genotype.—*Perissogomphus stevensi*, Laid.

Perissogomphus stevensi, Laid. l. c. pp. 384, 386 (1922); Fras., *ibid.*, p. 418 (1922).

Male. Abdomen 36–38 mm. Hindwing 33–34 mm.

Head: labium olivaceous; labrum olivaceous brown, its anterior border narrowly black, the outer corners and a pair of small median spots near the middle of anterior border yellow; anteclypeus and adjacent portion of postclypeus olivaceous; postclypeus dark olivaceous brown with an obscure large area against the eyes yellow. Frons deeply and widely notched at its centre, a beautiful grass-green above and in front, its extreme base above narrowly black; vertex and occiput black.

Prothorax black, the posterior lobe, a spot almost confluent with it, and a narrow anterior collar greenish yellow.

Thorax black on dorsum, grass-green laterally. The dorsum with a broad grass-green, M-shaped marking formed by the confluence of broad antehumeral stripes, which extend from the alar sinus, with a complete mesothoracic collar below. The middle limb of the M is formed by the middorsal carina which is green in its lower two-thirds, and confluent with the mesothoracic collar below. Laterally the vestiges of an upper dark brown, narrow stripe, and the hinder suture finely mapped out in the same colour.

Legs black, inner surfaces of anterior femora and distal half of same area on the mid femora greenish-yellow. Wings hyaline, a faint tinge of yellow at the extreme base in cubital area. Pterostigma blackish brown between thick black nervures; nodal index :—$\frac{12\text{–}16}{14\text{–}13}\Big|\frac{17\text{–}14}{12\text{–}13}$, $\frac{13\text{–}18}{13\text{–}12}\Big|\frac{17\text{–}11}{12\text{–}13}$.

Abdomen black marked at the base with grass-green, on other segments with citron yellow, as follows :—segments 1 to 7 with a middorsal stripe, broad on segment 1, trilobed on segments 2 and 3, broad at base on 4 to 6, on which segments it is confluent at the base with a narrow complete ring, and thereafter tapers away to a fine point, segment 7 similar but much broader at base, tapering less abruptly, and confluent at the base with a broad ventrolateral stripe which runs the full length of segment. The sides of segments 1 and 2 broadly grass-green, a triangular baso-lateral spot on segment 3 yellow, the sides of segments 8 to 10 broadly yellow-ochre, as also the apical half of dorsum of 10, where are seen two small round subdorsal subapical black spots.

Anal appendages yellow. Superiors as long as segment 10, a little divaricate, conical, tapering, acuminate, the apex slightly upturned and bearing beneath 4 or 5 small blackish brown spines. Inferior appendage about two-thirds the length of superiors, curling slightly up, deeply cleft into two short conical bluntly pointed divaricate branches. Genitalia. (See under genus.)

Female. Abdomen 38–41 mm. Hindwing 35–37·5 mm.

Entirely similar to the male, the face however more yellowish, the labium paler and the markings on abdomen more extensive, the whole of segment 10 being yellow. Nodal index :—$\frac{13\text{–}18}{16\text{–}13}\Big|\frac{17\text{–}14}{12\text{–}14}$; wings much more broadly tinted with yellow at base, as far out as the end of cubital space and along costa as far as the node. In one female, the whole wings are deeply and evenly enfumed brown, probably due to old age. The anal loop as highly developed as in the male.

Hind femora, as well as the other pairs, broadly yellow internally, and a fine diffuse stripe of the same colour on the outer surface, Anal appendages very short, conical, pointed, yellow. Vulvar scale (see under genus).

Distribution. The insect is taken during May and June. I have received specimens from Mr. H. Stevens taken at Gopaldhara, Assam, and others from Mr. C. M. Inglis taken near Pashoke, Darjeeling District.

The generic name implies ' redundancy ', and is well suited to this insect in which the venation is extraordinarily close considering the size of the insect, and by comparison with other Gomphines. Its venation is a curious blending of archaic with modern characters, a circumstance which makes it extremely difficult to determine relationships with other genera, it is however evident that broad gaps separate it from all other Indian genera.

Genus—ANORMOGOMPHUS, Selys

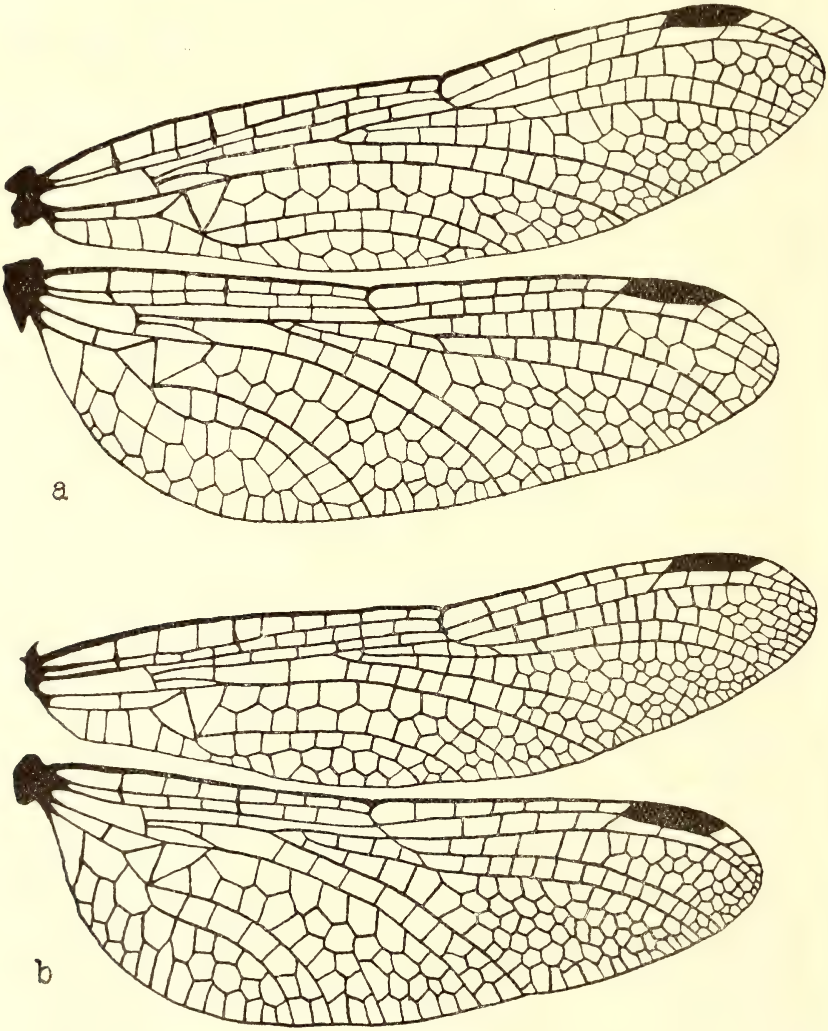


Fig. 5. *a* Wings of *Anormogomphus kiritschenkoi* Bart., male.
b. Wings of *Anormogomphus heteropterus*, Selys, male.

Anormogomphus, Selys, Bull. Acd. Belg. xxi, (2), p. 60 (1854) ; Mon. Gomp., p. 102 (1857) ; Will. l. c., p. 298 (1912), Laid. l. c., p. 396 (1922).

A genus of small Gomphines (equal in size to that of *Microgomphus*) characterized by their uniform pale colouring, without markings.

Wings hyaline, reticulation very open and simple, *base of hindwing rounded in both sexes, tornus absent*; arc between the 1st and 2nd, or opposite the 2nd antenodal nervure; sectors of arc parallel at, and for a short distance after origin, then divergent; a single row of cells in the postanal area of forewing, three in the hind, the 1st postanal cell in hindwing entire and extending proximad only as far as middle of base of subtrigone; no basal incomplete antenodal nervure; the 1st and the 4th the primary antenodal nervures, two cross nervures between *Mi-iii* and *Miv* in forewing, only one in the hind; all trigones, subtrigones and hypertrigones entire; trigone of forewing with costal and proximal sides equal, the distal rather longer; trigone of hindwing with costal side longer than proximal, and distal longer than costal; distal and costal sides of trigone of hindwing occasionally failing to meet, the gap being bridged by *Miv* to form a primitive four-sided trigone; only a single row of cells between *Mi* and *Mia* at level of distal end of pterostigma; pterostigma large and swollen, equal to a little more than one-fourth the length of distance between node and distal end of pterostigma, strongly braced; *Cuii* markedly pectinate in forewing; *Cui* and *Cuii* parallel in hindwing as far as termen; two rows of discoidal cells in forewing as far as level of node; one cubital nervure in all wings; *anal triangle single-celled.*

Head moderately large, frons angular, occiput flat and simple.

Thorax robust; legs rather long, extending well on to segment one; hind femora with a field of black, short, robust closely-set spines, the distal one rather longer than the rest, mid and anterior femora with smaller, more closely-set spines.

Abdomen slightly tumid at base, terminal segments slightly dilated in the male, of even width and cylindrical throughout in the female.

Genitalia prominent, lamina depressed, minutely notched; anterior hamules small and fine; posterior hamules long, projecting almost perpendicularly, tapering to a point, the apex with a tiny hook; lobe funnel-shaped, large and tumid. Vulvar scale very small, two small widely-divaricate, triangular scales.

Anal appendages very short. Superiors conical, pointed, widely separated, with a robust basal spine on the outer side; inferior deeply cleft into two widely divaricate branches each of which ends in a small black pin-head cap.

Distribution. Only two species are known, one of which is restricted to desert areas in Iraq, Persia and Sind, and the other to Bihar, Bengal and the Punjab. *A. kiritschenkoi*, Bart., the desert species, appears to be the more primitive, its reticulation being very open and simple, whilst *heteropterus*, Selys, has the venation much more close and static. The genitalia and anal appendages show that the two insects are intimately related.

Genotype—*Anormogomphus heteropterus*, Selys.

Anormogomphus heteropterus, Selys, Bull. Acad. Belg., xxi, (2), p. 61 (1854); Mon. Gomph., p. 103 (1857); Will. l.c., p. 293 (1912); Laid. l.c., p. 396 (1922).

Male. Abdomen 25 mm. Hindwing 22 mm.

Head pale whitish yellow, the eyes and ocelli brown and contrasting strikingly with the pale ground colour; an obscure brown line at base of frons above, and another in front of occiput. The latter simple, depressed, its border angulated at an obtuse angle.

Prothorax sandy yellow with obscure brownish transverse lines.

Thorax darker yellow with a grass-green tinge laterally. The dorsum with obscure vestiges of brownish lines, a median lining each side of middorsal carina convex inwards, an antehumeral stripe, more distinct, running obliquely from above down and out and lastly a humeral stripe, only visible at its middle part.

Wings pale, reticulation open, black, costa bright yellow; pterostigma pale yellow between black nervures, short, and stout, over 1 and 2 cells, braced; nodal index $\left.\frac{5\text{–}9}{6\text{–}7}\right|\frac{10\text{–}5}{7\text{–}6}$; 2 rows of discoidal cells, to beyond level of node.

Legs sandy yellow with black spines.

Abdomen pale sandy yellow marked with dark brown as follows :—A spot on each side of segment 1, a baso-lateral and an apico-lateral on segment 2, the latter spot transversely elongate, the jugal sutures and articulations of segments 3 and 6, these segments also having a small blackish brown spot on each side of the apical border ; segment 7 has a pale yellow basal ring, 8 and 9 a dorsal stripe on the carina of the same colour. The sides of these two latter segments, and of 10 darker yellow. The apical border of segment 10 rounded and not turned down between the anal appendages as in *kiritschenkoi*. Anal appendages yellow. Superiors a little shorter than segment 10, tapering to a fine point, widely separated, their inner borders parallel, the outer dilated at the base and prolonged downward as a very robust short tooth. Inferior appendage bifid, with widely separated branches, divaricate, their outer border thickened, tapering slightly towards the apex which ends in a curious oval black pin-head like structure.

Genitalia. Lamina depressed, shallowly notched ; anterior hamules small, conical, tapering ; posterior hamules more robust, projecting perpendicularly to long axis of abdomen, of even thickness to apex where they are abruptly conical and end in a short fine inwardly curved black spine ; lobe large, tumid, deeply bifid at lip, scoop-shaped.

Female. Abdomen 27 mm. Hindwing 25 mm.

Very similar to, but larger than the male. Closely resembles in many respects the female of *kiritschenkoi*, but the reticulation of the wings is much more redundant, as in the male.

Head (missing in the only known specimen of the sex).

Prothorax similar to the male. Thorax yellow laterally, grass-green on dorum with some obscure dark brown stripes, viz.—the upper part of the middorsal carina, a well-defined antehumeral stripe running from the alar sinus above, very obliquely down and out and becoming lost in its lower third. A short obscure line on the upper part of the humeral suture and a broken line on the second lateral suture.

Legs greenish-yellow with black spines, numbering about 15-20 on the hinder femora.

Wings hyaline, similar to the male, nodal index $\frac{5\text{–}9}{6\text{–}7}\Big|\frac{10\text{–}6}{7\text{–}7}$; *Cuii* pectinate in forewing ; two rows of discoidal cells to well beyond level of node.

Abdomen yellow with a greenish tinge, marked obscurely as follows :— Segments 2 and 7 with a subapical, subdorsal oblique linear spot on each side convergent apicad ; segments 8 and 10 ferruginous with the subdorsum and subapical borders clouded with black, segment 10 with the base similarly clouded on the dorsum.

Anal appendages ferruginous, very small, conical, separated by a similarly coloured conical structure. Vulvar scale very minute, two tiny triangular processes on either side of hinder border of segment 8.

Distribution. Type, a male in the Selysian collection, from India, without further data as to locality, collected by Stevens. There is a male from Lahore in the Indian Museum collection and a third male in my own collection from Bihar, the latter very teneral and without any evidence of markings. The only female known is one in my own collection, without head and anterior two pairs of legs. Its colour is well preserved, especially of thorax. This specimen comes from Baghwonie, Bengal and I believe was taken by Mr. C.M. Inglis, June 27, 1922. The insect appears to be much rarer than *kiritschenkoi*, or it may be overlooked on account of its weak flight and colourless body and wings. The above description has been taken from the Bengal specimen.

Anormogomphus kiritschenkoi, Bartenef.

> Morton (*Odonata from Mesopotamia*), Ent. Month. Mag. (3), vol. v, pp. 143-151, 183-196 (1919) ; Id., Ann. Mag. Nat. Hist. (9), vol. v, pp. 296, 297 (1920).

Male. Abdomen 29-31 mm. Hindwing 24-25 mm.

Very similar to the last species but rather more colourless, and the reticulation of wings more simple and open.

Head. Lips, face and vertex palest greeny white or creamy, the ocelli and eyes dark brown and strongly contrasted against the pale ground colour. Occiput pale, its hinder border obtusely angled prothorax palest yellow, rather darker on the dorsum. The posterior lobe and a transverse ridge in front of it brighter greenish-yellow. Thorax pale green, yellowish in some specimens but very variable and almost grass-green in others, unmarked. The dorsum a darker olivaceous.

Legs yellow, all femora with a longitudinal brown line on the outer sides, dark and well-defined distad, paler and diffuse proximad, and much darker and better defined on anterior than hinder femora. Spines shorter but more numerous and more closely-set than in *heteropterus*.

Abdomen sandy yellow with subapical, subdorsal spots on segments 2 to 6 exactly similar to *heteropterus*. Segments 7 to 10 unmarked.

Anal appendages yellow, the superiors with a pale greeny tint, the inferior ferruginous. Superiors very broad at base, conical, ending in a sharp point, outer borders oblique and ending in a very robust basal brownish spine, widely separated by a prolongation of segment 10, which dips down between them and ends in two small conical tubercles, each with a dark brown spine at its summit. Inferior deeply bifid, with widely divaricate branches which are bluntly pointed and end in a small black apex.

Genitalia very similar to that of *heteropterus*. Lamina very depressed, its surface with a narrow deep fissure dividing it up into two convex areas; anterior hamules conical and short in profile, sloping back and down, parallel, flattened as seen from below; posterior hamules much more robust, conical, ending in a tiny forwardly directed spine, cream coloured, projecting very slightly back, and almost perpendicularly so, to long axis of abdomen; lobe dark olivaceous, scrotal-shaped, narrowly but deeply notched at apex.

Wings hyaline, costa and most of the nervures pale straw coloured; pterostigma pale with a pinkish tinge, between black nervures, over three cells, braced; nodal index $\frac{7-8}{6-6}\Big|\frac{9-6}{6-5}$, $\frac{6-10}{7-7}\Big|\frac{10-6}{7-7}$; discoidal field in forewing with two rows of cells nearly to level of node.

Female. Abdomen 29–31 mm. Hindwing 26–27 mm.

Similar in all respects to the male; nodal index $\frac{6-9}{6-7}\Big|\frac{9-6}{7-6}$; two rows of discoidal cells in forewing to level of node; pterostigma slightly longer. Vulvar scale as for genus.

Distribution. Iraq, Persia along the shores of the Gulf, the Mekran coast and Sind. I took this species in large numbers at Zobeir, Mesopotamia, in April 1915, when in camp during the War. Its numbers were so great as to afford an exclusive diet for a large family of lizards I was keeping at the time. Its flight is weak and not sustained. It may be found near its breeding places settled gregariously on low bushes, or in grass. At Zobeir, the inhabitants dig holes in the sand for their water supplies, fresh pits being dug as one becomes fouled. It is in these pits that *kiritschenkoi* breeds.

Baghdad is the most northern locality from which I have received specimens, it occurs later there, towards the end of August. It is probably not uncommon along the banks of the lower Indus.

(*To be continued*)

LUMINESCENCE IN PLANTS AND ANIMALS

BY

E. BLATTER, S.J., Ph.D., F.L.S.

[*Read at the Meeting of the Bombay Natural History Society held on June 24, 1926.*]

WHAT IS LUMINESCENCE ?

Various kinds of luminescence have been distinguished in course of time. There is first of all crystalloluminescence. This is a phosphorescent light which can be observed when some substance crystallizes from solution or after fusion. A good example is arsenious acid when crystallizing from solution in hydrochloric acid. Triboluminescence is a second kind. It can be obtained by mechanical means, either by friction, percussion, or cleavage. If we break sugar in the dark, or if we rub two crystals of quartz together, a flash of light can be observed. A third kind is electroluminescence, and this is due, as the name implies, to electrical causes. If we pass an electric discharge through certain gases, the gases themselves become phosphorescent for a short time. As a fourth kind we may mention Thermoluminescence. There are some bodies which do not show any light in a dark room at ordinary temperatures, but they begin to do so as soon as they are heated to a temperature below a visible red heat. In a variety of fluorspar, called chlorophane, the heat of the hand is sufficient to produce luminescence. We come to the fifth kind of luminescence, viz. photoluminescence. It comprises two phenomena: phosphorescence and fluorescence. Phosphorescence consists in the emission of a pale, more or less ill-defined light, not obviously due to combustion. The meaning of the term phosphorescence has not always been the same. At present it is, for practical reasons, restricted to the case of bodies which, after exposure to light, become self-luminous. By this we can distinguish phosphorescence from fluorescence. In fluorescent bodies light is only emitted whilst they are under the influence of a certain illumination, and the light ceases as soon as the source of illumination is removed.

It is evident that none of the five kinds of luminescence just mentioned can be adduced to explain the luminescence in animals and plants. That it is not crystalloluminescence or triboluminescence or even electroluminescence, does not require any proof. Thermoluminescence is excluded by the fact that luminous organisms or organs do not show any measurable increase in temperature. We might think of phosphorescence, as the pale glow in certain organisms resembles the light emanating from phosphorus, and opinions were not wanting which attributed light-phenomena in living organisms to the presence of phosphorus.

But it is well known that phosphorus and its luminous compounds are deadly poison to every living tissue. We cannot therefore assign the luminescence of life to the oxidation of phosphorus.

It is only chemoluminescence which gives us a satisfactory explanation of luminescence in organisms. We know that a number of elements enter reactions which produce light. At the same time we are not in a position to put down universal characteristics either regarding the bodies which enter such reactions, nor regarding the reactions themselves.

WHAT WE DO NOT CALL LUMINESCENCE

Before I proceed I wish to exclude from the present paper certain phenomena which sometimes go under the name of luminescence, I mean the shining of the background of the eyes of certain animals, especially of cats, and the flashes of a certain moss *Schistostega osmundacea.* In both cases we have no self-luminescence, but the incident light is so strongly reflected in certain directions as to produce the impression of self-luminescence. In animals the light is reflected by a layer of tissue which contains microcrystals or strongly refractive fibrils. A similar mechanism produces light in some sea-weeds of the genera *Phylocladia*, *Polysiphonia*, *Wrangelia* and *Cystosira*, in which the light is reflected by microscopic plates of a certain shape. Contrivances of a similar character cause the glittering of the leaves of *Hookeria splendens*, and the golden gloss of the sea-weed *Chromatophyton rosanoffii.*

A curious luminosity can be observed in the twilight or during night in many red or blue flowers, e.g., *Papaver orientale*, *Helianthemum oenothera*, *Lilium bulbiferum*, *Calendula officinalis*, *Tagetes patula*. We do not know the exact nature of this phenomenon; so much, however, seems to be certain that it is not a case of chemoluminescence. We need not decide in this place whether it is due to electricity or to a physiological-optical process.

DISTRIBUTION OF LUMINESCENCE

The power of producing light seems to be found in the most diverse types of organization of animals and plants. Only amongst multicellular green plants and warm-blooded animals we meet large groups which do not contain any luminous forms.

Many bacteria of putrefaction are known to be phosphorescent. If we sometimes find that dead fish or molluscs or flesh emit light, we have to ascribe it to the presence of bacteria. When put under the microscope the individual bacteria appear as shining points of light.

Luminescence is a common occurrence in decaying wood and leaves. Here it is due to the mycelium of a fungus, *Agaricus melleus* and other species of *Agaricus*, also of species of the genera *Collybia*, *Pleurotus*, *Panus*, etc.

In biological literature we come across a number of references to luminous animals which are not really self-luminous, but which have been infected by luminous fungi and bacteria. Observations on luminous mosquitoes and mole-crickets find here an explanation. In America we meet the so-called lantern-flies, belonging to the

Homoptera. The luminous organ consists of a huge projection of the front of the head, but even here the light seems to be due to the presence of fungi or bacteria.

The *Protozoa* and *Protophyta* have many luminous representatives. It is interesting to note that only those forms are luminous which live in a medium rich in salt and that so far no forms have shown luminosity in fresh water. In sea water they cause the beautiful phenomena of phosphorescence. The most common luminous species are *Noctiluca miliaris* (Flagellata), *Peridinium divergens* (Algæ), and species of *Pyrocystis*. The first two are found near land, and the latter in mid-ocean. A number of bacteria cause a kind of surface-luminosity of the sea. The light seems to be continuous without exhibiting visible points of light.

We come to the higher animals. Here the luminescence begins to be confined to special parts of the body which may develop into highly specialized luminous organs. Many *Cœlenterata* make a beginning of such localization. Some *Medusæ* may be luminous all over, but the light is more pronounced along the radial canals, in the ovaries, or in other parts of the body. In *Pennatulidæ* each polyp is adorned with eight luminous bands on the outer surface of the alimentary cavity. Some of the finest displays of marine luminosity we owe to *Pyrosoma*, a member of the *Tunicata*. The light emanates on stimulation from two small patches of cells which are located at the base of each inhalent tube.

Of the Crustaceans many pelagic *Copepoda* are luminous. The light appears to be produced by a fluid which is secreted by certain glands of the skin. A similar luminous secretion is produced by the Ostracod *Pyrocypris* and the Mysid *Gnathophausia*. In the *Euphausidæ* we observe elaborate luminous organs situated on the thoracic appendages and the abdomen. Many families of the *Decapoda* have luminous representatives and some deep-sea prawns discharge a luminous secretion at the bases of their antennæ.

Other luminous inhabitants of the sea are luminous sponges, luminous corals (*Alcyonariæ*), luminous sea-urchins (*Diadema setosum*), luminous starfishes (*Brisinga*), luminous species of *Amphiura*, *Ophiacantha*, *Ophiopsila*, a luminous rock-boring Mollusc (*Pholas*) which Pliny already knew to be luminescent, luminous worms (*Chætopterus*, *Nereis*) and a great number of Cephalopods which are for the most part denizens of the deep sea.

Amongst the legions of insects very few produce light. There is the primitive *Neamura muscorum*, and of the higher orders the glow-worm (*Lampyris splendidula*) and his near relative *Luciola italica*, and the tropical fireflies (*Pyrophorus*). In India we have numerous species of glow-worms, usually, but erroneously, called fireflies. The true fireflies which belong to the family *Elateridæ* are not found in India. In our glow-worms the posterior segments of the body cover the luminous organ. In many species the males alone have wings, whilst the female has no wings and resembles a grub. Both, the grub-like female and its larva are luminous. In various families of beetles, chiefly outside of India, luminosity has been noted (*Carabidæ*, *Paussidæ*, *Staphylinidæ*, *Tenebrionidæ*, *Elateridæ*, *Cerambycidæ*, *Buprestidæ*, etc.). Even larvæ of *Lepi-*

doptera and *Diptera* have been seen to emit light, but it is more likely that the light is due to the activity of bacteria or fungi than to auto-photogenic processes. Some Centipedes, e.g. *Geophilus electricus* and *G. phosphorus*, conclude the series of luminous Arthropoda on land. They are said to leave a luminous trail when allowed to crawl over the skin.

Many deep-sea Teleostome fishes (*Stomiatidæ*, *Scopelidæ*, *Halosauridæ*, *Anomalopidæ*) are provided with characteristic luminous structures, called photophores, whilst many species of *Selachii* show numerous simple luminous organs which vary a good deal as to number, distribution and complexity in different fish.

The Process of Luminescence

If we want to get an insight into the material process of luminescence in animals and plants, we have to consult the investigations on the production of light during chemical processes. Amongst the organic compounds which produce light on undergoing transformations some are products of organisms, or at least bodies nearly related to products of the living substance, e.g. aldehydes, monovalent saturated primary alcohols, certain fatty acids, aromatic oils. As to the particular kind of reaction during which luminescence can be observed, we are told by chemists, that they are chiefly those in which oxygen or halogens are reacting on the compounds mentioned above. For the luminescence of organisms only the first possibility seems to be realized : the light of organisms depends strictly on the presence of oxygen. It is always a question of oxidation of bodies which we call ‘ photogens ’, according to their power of entering luminous reactions. It must be remembered, however, that the word photogen does not signify a chemically uniform body.

What is the activity of the luminous organism ? It consists in the production of the photogen. The photogen may, by auto-oxidation, unite with oxygen so rapidly as to cause luminescence, or the organism may, in addition, produce special bodies which accelerate the process of the luminous reaction. We could call such bodies oxidases, as we have before us a process of catalytical acceleration of oxidation. In this case we would have to consider organic luminescence as a process of fermentation.

Observations on the boring mollusc, *Pholas dactylus*, seem to speak in favour of this hypothesis. The luminous slime of that mollusc is said to contain two bodies : the luciferin which would represent the photogen, and the luciferase which would be the oxidase. Neither body is luminous by itself, but they become so after union.

Most reactions of fermentation, and especially oxidation, take place intracellularly in the living substance and, consequently, the process of luminescence is very often brought about within the cells. We can observe intracellular luminosity in luminous bacteria and fungi, in luminous protista and insects, fishes and many Crustaceans.

In other cases luminescence is extracellular. There are animals whose secretions begin to become luminous after their separation from the animal body. It is possible to obtain considerable quantities of luminous slime from the boring mollusc mentioned before, and that slime continues to shine even after having passed through porcelain filters. Similar conditions have been detected in certain marine Crustaceans (*Copepoda* of the families *Centropagidæ* and *Oncæidæ*). Under the microscope we can observe how the dermal glands expell little masses of secretions which begin to shine only when they come in contact with the sea water.

These facts are of great theoretical importance. They show that it is possible to separate the processes of luminescence from the vital processes of organisms. The living substance furnishes the bodies that can become luminous and, at the same time, the condition of luminous reactions (apparently an oxidase).

THE PHYSICAL PROPERTIES OF THE LIGHT OF ORGANISMS

The spectra of the light of various organisms have been observed and they were found to be continuous, but not reaching either end of the spectrum of the sun. The light of organisms, therefore, if sufficiently intense, could be seen in the different parts of the spectrum as orange, yellow, green, blue and violet. But in most cases the total intensity of the light is so small that our eyes can perceive differences of light only, but not of colour. In the spectrum of the strongly luminous *Bacillus Lucifer* Molisch was able to distinguish real colours, viz. green, blue and violet.

The data we find in biological literature and notes of travellers are not always reliable. Many observers seem to forget that observations of this kind must be made after one has spent at least thirty minutes in the dark. Aberrations from the pure white tint are noted chiefly in the direction towards yellow, yellowish-green, green or blue, but the colours rarely reach considerable saturation. Thus, the light of the male glow-worm is yellowish-green, a colony of *Bacterium phosphoreum*, bluish-green or even smaragd-green, of *Pyrosoma giganteum*, ultramarine blue. There is an isolated reference to the effect that after irritation the light of *Pyrosoma atlanticum* becomes red.

We must carefully distinguish between the light produced by the luminous reaction and that of the luminous organ. As the latter are very often provided with reflectors and lenses it is not difficult to understand how colours quite different from the colour of the luminous reaction may arise. We know a deep sea Cephalopod (*Thaumatolampas*) of which the luminous eye-organs are ultramarine blue, the five ventral ones sky-blue, and the two anal ones ruby-red. But we are not allowed to draw the conclusion that three different processes of luminescence, each with its own characteristic colour, are going on.

Of the intensity of organic light we know very little. It has been calculated that the light of a luminous colony of *Vibrio Rumpel*, covering an area of 2,000 square meters, would equal that of one Hefner's candle. It is not impossible that in many cases good results might be obtained by photographic methods. As to the efficiency of the light emitted by many fireflies, Bainbrigge Fletcher remarks that it is 'remarkably high, being estimated at practically 100 per cent of the energy used, there being almost no heat-rays or actinic rays, whilst the light-value of the electric are is only about ten per cent of the energy used and that of the sun only about thirty-five per cent.'

The Function of Luminescence

There seems to be no case where the presence of luminescence forms an integral part of organized life. Luminous bacteria can lead a normal life and develop in the usual way without producing light. As to luminous secretions there is no reason why we should ascribe to them a function different from that of similar secretions, which however do not emit light.

Our conjectures seem to be on somewhat firmer ground when we consider not the internal life of luminous organisms, but their ecological and social relations. We know Cephalopods with about 1,000 luminous organs, and they are mostly inhabitants of the deep sea. Can those organs not serve as recognition marks? It is not unlikely that fishes use their luminous organs as lanterns in the dark abysses of the sea. In the females of the glow-worms and fireflies the luminosity is probably a sexual lure. In the males its function is not known. It is not impossible that the intermittent flash of a flying glow-worm is a means of defence by puzzling an enemy as to its whereabouts. Bainbrigge Fletcher thinks that there is also some evidence that Lampyrid beetles are distasteful to nocturnal insectivorous birds and bats. In this case the light would be a ' warning ' signal.

Let us not forget that all this is mere conjecture, and we must not flatter ourselves at having explained the functions of those mysterious and beautiful phenomena of luminescence. What we require is experimental material, and when we have obtained it we have to sift and interpret the facts, not from the point of human experience, but taking into consideration all we know of animal psychology.

THE MASON WASP (*EUMENES CONICA*)

BY

MAJOR R. W. G. HINGSTON, I.M.S.

PART II

ARCHITECTURAL PROBLEMS

(*Continued from page 247 of this Volume*)

I continue the investigation of this mason wasp. There are certain points relating to architecture which deserve an additional note.

Rapidity of Construction

Consider, for example, the mason's industry. See how quickly her edifice is built.

I find a nest of two cells. The mason is about to commence the third. She arrives at 1.52 p.m. to lay the first pellet in place. It takes her a minute to effect this. Not till 2.34 p.m. does she bring a second load, an unaccountably long absence in the usual mechanical routine. After this, however, there is no more delay. Every two minutes she brings a fresh globule and spends a similar time in moulding it on the cell. In all fifteen pellets are brought. Fourteen go to the masonry: the fifteenth is required for the rim. By 3.18 p.m. the edifice is complete. Such is the measure of her industry. The work is commenced at 1.52 p.m.: it is finished at 3.18 p.m. Eighty-six minutes are required to raise this inimitable work.

But we are not giving due credit to the mason. I have said that after laying the first pellet she made a delay of thirty-five minutes before resuming work. This is an abnormal occurrence. Let us neglect it. The result is that it takes her just under an hour to construct one cell.

The hunt for caterpillars now begins. In the instance under observation she is very successful. After twenty-six minutes she is back with a victim. One more minute is spent in packing it. In forty-two minutes she brings a second; in five more minutes a third; in thirty-two minutes a fourth. All in succession are stuffed in; the chamber is packed tight. It is 5.3 p.m.

But her work is not over yet. The gate of the prison must be closed. In four minutes she is back with a pellet which is pushed into the door. It happens in this case that one is insufficient. So in another minute she brings a second; the door is hermetically sealed. It is 5.8 p.m.

The cell is built, the egg layed, the caterpillars have been hunted down and stored, the door is firmly closed. All is complete. It has occupied the *Eumenes* three hours and sixteen minutes. The sun is now low in the sky. Nevertheless the architect refuses rest. In eight minutes she is back again. Here and there are some depressions on her masonry, mere superficial unimportant irregularities, yet blemishes which appear not suited to her taste. Till nightfall she attends to their improvement. Bits of clay must be smeared on uneven places until the whole is smooth.

Here is a full record of the mason's industry.

ARCHITECTURE OF A CELL OF *Eumenes conica*

Architecture begins

(1)	Arr. 1.52 p.m.	(6)	Arr. 2.47 p.m.	(11)	Arr. 3.5 p.m.
	Dep. 1.53 ,,		Dep. 2 50 ,,		Dep. 3.7 ,,
(2)	Arr. 2.34 ,,	(7)	Arr. 2.51 ,,	(12)	Arr. 3.10 ,,
	Dep. 2.36 ,,		Dep. 2.53 ,,		Dep. 3.12 ,,
(3)	Arr. 2.37 ,,	(8)	Arr. 2.56 ,,	(13)	Arr. 3.13 ,,
	Dep. 2.39 ,,		Dep. 2.57 ,,		Dep. 3.15 ,,
(4)	Arr. 2.41 ,,	(9)	Arr. 2.59 ,,	(14)	Arr. 3·16 ,,
	Dep. 2.42 ,,		Dep. 3.1 ,,		Dep. 3.17 ,,
(5)	Arr. 2.44 ,,	(10)	Arr. 3.2 ,,	(15)	Arr. 3.18 ,,
	Dep. 2.46 ,,		Dep. 3.4 ,,		Cell completed and egg laid.

Storage begins

(1) Arr. 3.44 p.m. with caterpillar.
(2) ,, 4.26 ,, ,,
(3) Arr. 4.31 p.m. with caterpillar.
(4) ,, 5.3 ,, ,,
Storage complete.

Sealing of Aperture begins

(1) Arr. 5.7 p.m. Inserts first plug.
(2) Arr. 5.8 p.m. Inserts second plug.

Final touches to Cover begin

(1) Arr. 5.16 p.m.
(2) Arr. 5.30 p.m.
(3) Occasional visits till 6.15 p.m.

Geometrical Measurements

I come to another point. How does the architect measure her building? By what means does she manufacture ovals and cupolas? Has she any geometrical sense? Clearly she cannot work haphazard; there must be some principle underlying her actions. Only by some geometrical instinct could she raise a geometrical cell.

I believe that she has geometrical appreciation. Here are the reasons. I will show that she is able to measure distances, that her masonry is based on a rhythmical principle, that she clearly appreciates the nature of a circle, that she can estimate height.

First with respect to the use of her antennæ. The human architect employs a measuring-rule and plumb-line. The antennæ are the wasp's corresponding instruments. It is they which ensure the shape of the cell. Observe her at the preliminary inspection. Her antennæ all the time test the site, now separating, now coming together, surely surveying, perhaps measuring the ground. The same is evident during construction. Everything is touched by these sensitive threads. Their points sweep across the floor, occasionally stretching from side to side until they reach the opposite wall. They search out irregularities, faults in architecture, follow each detail in the application of the pellet; clearly they are important organs which secure geometrical exactitude in the work.

Now for their employment as measuring instruments. Watch the placing of the individual pellets. Each pellet is, so to speak, a brick in the architecture, firmly built into the wall. Observe her behaviour with respect to the first brick, the foundation-stone of the cell. Often it is just a plain ridge of mud, but at times I see an instructive modification. The mason divides her first brick. She cuts it into two more or less equal parts, placing the halves at different points. Having done this, not casually but with much care, she goes off for a second load. Now, why has the mason acted thus ? Why should the first brick have this special attention ? What is the particular advantage gained ? The explanation is not difficult. By dividing her first pellet she delimits the ground, places landmarks to define the area apportioned to that cell. Here, therefore, is a geometrical operation. The first brick is cut into parts. One part is fixed at opposite extremities of the area which will support the cell. But how does she estimate the distance between the parts ? Clearly by means of her instruments of measurement, by the divergence of her antennæ to the widest possible degree. For the threads open, diverge sufficiently for the tip of each to be applied to a part. The antennæ are geometrical organs. The mason employs them as a pair of dividers with which to measure the distance between her bricks and delimit the earliest foundations of her cell.

So much for the first brick. Now for the rhythm in her work. Facing us is a chamber undergoing construction. It will be convenient for our purpose to divide it into parts. It will have an upper margin, a lower margin, a right and a left. The first brick has been laid in place, one half on the right, the other half on the left of the site. The second brick arrives. It is placed on the left. The third brick goes to the right, the fourth to the left, the fifth to the right, and thus a system of alternation in position is introduced into the architecture of the wall. The upper and lower margins are as yet untouched. All the work has been on the right and left. But now she starts on the upper margin. The sixth brick is introduced there ; then the seventh to the left and the eighth to the right. Then she turns to the lower margin. Again we observe the alternate sequence, first a brick to the left than the next to the right of the wall. And so on throughout the whole work. Of course the pellets are spread out and overlap. Some may be small, others large, nevertheless the rhythm is distinct. As her cell grows narrower, the bricks make longer segments. The twelfth, in the instance under observation, is applied to the whole of the left half of the wall ; the thirteenth is inserted into the whole of the right half ; the fourteenth is kneaded right round the circle ; the fifteenth is moulded into the rim.

An alternating system, a kind of pendulum behaviour ; is not this a geometrical act ?

I do not suggest that the routine is unchangeable, that the sequence just described is identical in every cell. Instinct is not so inexorable. The routine will vary, but only in detail. The wasp has not the bricks of a human mason, all cut to uniform size and shape. Her pellets necessarily vary ; so will the architecture of her walls.

But the principle, the alternating behaviour, does not change. Rhythm is an essential feature in her work.

Another point before we leave the bricks. The wasp shows engineering skill. A builder, when raising a brick wall, works on a definite plan. He does not place his bricks just anyhow. Each brick is fixed so that its centre rests on the junction of two bricks beneath. This results in an overlapping, a necessary feature in a rigid wall. The insect-mason is equally efficient. She has adopted the builder's plan. Her pellets are not piled just one above the other; on the contrary they overlap and are dovetailed together. She has introduced the same fundamental principle into the architecture of her cell.

Now for another geometrical act. I have said that the wasp can appreciate a circle What is the proof of this ?

Remember the shape of the cell aperture. It is a circle, remarkably perfect. It might have been made by a drill. How does the architect effect this ? Again we find that the antennæ are responsible. Watch her when engaged at moulding the rim. Her antennæ are thrust into the gate. They gently separate until they touch the edge on opposite sides. Then the wasp rotates a little, her antennæ go with her, and, having separated a second time, measure another diameter of the hole. She continues to rotate, the antennæ to measure. At the same time she moulds the viscid edge in accordance with the information which the antennæ supply.

An experiment will prove the point. A cell is almost built. The gate is in position. The wasp at her next visit will mould around it a rim. While she is absent I alter its shape, converting the circle into an ellipse. The mason, on her return, appreciates the alteration. An elliptical aperture will not suit her purpose; it must be of a circular shape. Her antennæ tell her that it is out of order. In one diameter they separate widely, in another diameter the divergence is less. Consequently the mason is dissatisfied. What does she do ? She has brought with her the usual pellet, the one intended for the rim. Now she employs it in a different manner. She divides it, introduces one piece into one end of the ellipse, the other piece into the opposite end. Then a repetition of measurements follows, also a touching-up all round the edge, with the result that the ellipse disappears and the circular shape is restored.

Thus is the mason a geometrician. Her antennæ are sensitive callipers. By their use she can measure distances and shape a circle from an ellipse.

One more geometrical point. The *Eumenes* must have some special means by which to estimate height. How does she determine the point when her dome is sufficiently raised ?

As before the manner is geometrical. Again the antennæ are employed. We have already watched her building and observed how she thrust her antennæ into the interior and swept them across the floor. When the wall is still low the antennæ touch the floor the moment they are pushed into the cell. Also they bend while being swept across. As the wall rises higher the antennæ bend less owing to the increase in distance between the top of the wall and the floor. When the wall has reached full height only the extreme antennary tips are able to touch the floor. The mason then knows that the height is correct. Her antennæ have become a pair of plumb-lines with which she sounds the depth of her cell. Surely a simple and instructive mechanism. It implies of course that the length of her antennæ must equal the cell depth. Such is the case. They both measure three-eighths of an inch.

Thus it is clear that geometrical principles underlie the architecture of this oval cell. What wonderful implements are these antennæ, mapping foundations, measuring diameters, shaping circles, estimating heights.

Architectural Foresight

Can a wasp, when commencing to build, foresee her finished work ? Or can she take thought for but a single cell ? It is an interesting psychological point.

Eumenes dimidiatipennis will enlighten us on this particular. Her nest is like that of the cone-shaped mason, the chambers being similar in size and shape. But *E. dimidiatipennis* arranges them differently. She prefers to place them in a long line, the cone-shaped mason in an irregular heap.

One morning, while searching an empty house, I came on an example of this mason's work. Two of the cells had been completed ; the wasp was about to commence the third. But here is the point of particular interest. In addition to the two completed chambers the wasp had mapped out the scheme of architecture for all the subsequent cells. She had built ridges of mud, fixing them to the wall in such situations that each would form part of a cell. They were elongated flakes, vertical on one side, shelving on the other, in fact a series of foundation-stones arranged in a long line. Their purpose was obvious. They were the mason's landmarks on which the whole architecture was based. Each ridge was the foundation-stone of a constituent cell. The wasp at the very commencement of her labour had prearranged for the whole work.

This would seem to imply some mentality. Her instinct is not limited to a single chamber. She can see in advance the plan of architecture, can calculate the respective position of compartments, can form an idea of the finished work.

Egg-laying Instinct

I come now to the egg-laying instinct. There is one point on which the wasp is very particular. She will fix her egg in one place only, at the very top of the inside of the cell. From this she never makes the slightest deviation. The importance is one of security. The egg, when fixed to the extreme summit, is safe from the squirming of the caterpillars beneath.

An opportunity offers for an experiment, a psychological test. I cut away the top of a cell before the egg is layed. The breach is a large one. It has involved the exact portion of the roof to which the mason will attach her egg. Let us watch her behaviour when the time comes for her to lay.

In goes her abdomen after the usual manner, then up towards the roof. I can see all her movements through the artificial hole. She feels for the surface against which to lay. This surface is gone, so out comes her abdomen. She becomes agitated, inspects the breach. There is something very amiss. Again her abdomen enters and she makes a second attempt to lay. Another failure: her annoyance becomes more acute. She goes back to the breach, looks into it, then returns to the gate. By this time she is wildly impatient, clearly being forced into immediate action by the bursting pressure of the egg within her womb.

But instinct prevents her seeking relief. There is plenty of space within her chamber. She might fix her egg anywhere, to the sides, to the floor. But she will not do this. To the roof only will she trust her egg. What can she do when the roof is gone? Back again she goes to make still another effort, for the force of reproduction can no longer be restrained. In the open breach she begins to lay. It is not a mere effortless emission. She has to exert a repeated strain in order to eject this product of her womb. There is a convulsive impulse, strain follows upon strain, until the egg is expelled. But what of its attachment? None is made. The egg is layed in the air and tumbles down to the bottom of the cell. Instinct, or rather the inflexibility of instinct, has brought complete failure to the wasp. Under new conditions, outside her experience, she will not deviate a fraction of an inch in order to anchor her egg.

Development

Our last point concerns development.

The egg is pale yellow, an elongated oval, in length one-eighth of an inch. Suspended from the roof by a slender filament, it dangles into the cell.

During the first few days it expands slightly, lengthening to a curved ellipse. There is a definite change at the end of the second day. A larva pushes its head through the capsule in order to reach the provisions below. The first caterpillar is attacked. With this the larva's colour changes, the pigment from the food making it dark green. It still remains attached to the suspensory thread.

The rich juice of living caterpillars results in rapid growth. By the fourth day it is a vigorous larva, with body rings clearly defined and internal organs visible through the skin. Moreover it has broken from the suspensory thread and moves about in the midst of its food. What insatiable voracity develops! Its jaws are incessantly chewing at the caterpillars. So gorged are its entrails with yellow juice that we can see them swelling and pulsating through the skin. Although scarcely half an inch in length, it has devoured most of the supplies.

By the seventh day it is full grown, a fat fleshy grub, swollen in the centre, tapering at the ends, about four-fifths of an inch long.

The skin has lost its delicate transparency, the green colour has disappeared. It is now uniform yellow and opaque. All desire for food has gone. Activity also has declined. This forbodes the pupal state, the long motionless sleep. All provisions are consumed. Only its ejections and some indigestible material remain imprisoned with it in the cell.

On this day occurs an important event. The larva fashions a cocoon. The vestment is of silk, thin, translucent, of firm texture, somewhat rigid in substance, tightly spread and closely applied to the wall. Secure within this protective sac the larva falls into a trance. It lies motionless, slightly bent, resting loosely in the silken garment awaiting the subsequent change.

By the tenth day there are further developments. A bright yellow colour has come over the larva. Body rings have deepened into clefts. A constriction now encircles it that looks like a broad waist.

Specially important is the eleventh day. A transformation occurs with such remarkable suddenness that we are astonished at the wondrous change. The structureless segmented maggot vanishes. A perfectly formed, though helpless, wasp replaces it within the silken sheath. This commences the pupal stage. Larval life has ended. Before us is a delicate model of what is obviously a young wasp.

Still the state of trance envelops it. None of its organs show a sign of motion, yet all essential parts are visible, most of them elaborately formed. Its head is flexed, the eyes are distinct on either side, the antennæ are neatly turned in beneath, even the fine appendages about the mouth are now clearly defined. Its abdomen is bent, its stunted wings are against its sides, its legs are curled in towards the middle line. The attitude is one of bodily flexion. Trunk and organs are neatly folded so as to occupy the smallest space. Thus it passes through the pupal sleep.

Next day we observe a faint change in colour. Hitherto a vivid yellow, now a trace of dark pigment appears. The eyes have changed into brown spots. Some black develops in the wing stumps. Pigmentation increases as the days advance. The eyes pass through varying hues of brown until in five days they are absolutely black.

The pigment deepens. Another day brings out a thick black line across the head, a dark transverse stripe near the base of the abdomen, a trident of three diverging lines along the middle of the back. The wasp is losing the brilliancy of youth and developing its adult dress.

In another day it is tawny red. A black line has appeared upon the pedicle. The yellow which decorates the adult head is now quite distinct. Moreover the wasp shows some sign of sensibility. It is feeling the first thrill of vigour. The hour of awakening is at hand.

By the twenty-first day the change of colour seems complete. All the attributes of the perfect wasp are present except that the wings are still mere stumps. The sleep continues, but less intense.

The slumberer, lying curled, now responds to a touch. It bends itself, extends its legs, obviously about to awake.

The event takes place on the twenty-second day. Sensibility increases. New strength develops. The sheaths, which up till now had clothed the wings, are cast completely off. Those fragile organs are withdrawn, then spread out to dry. The metamorphosis is over. Development is complete. For a day the wasp remains in its prison. Its limbs and integument are still tender: its transparent wings are not yet prepared to meet the vicissitudes of flight. After a day these joints and membranes harden. Then its jaws attack the masonry. It eats through the mortar that blocks the gate and emerges into the open air.

(*To be continued*)

DRAGONFLIES

A REVISION OF THE GENUS *ZYGONYX* SELYS

BY

MAJOR F. C. FRASER., I.M.S., F.E.S.

(*With a Text Figure*)

The genus *Zygonyx* was created by De Selys in the year 1866, but being too fully occupied at the time with his other work, *Synopsis des Agrionines*, he passed on the characters to his friend and collaborator Dr. Hagen. (*Causeries Odonatologiques*, No. 4.)

Dr. Hagen in the following year published a definition of the genus for the first time (*Hagen*, *Zool. Bot. Wien.*, *17*, p. 62, 1867). Selys had mentioned the names of two species to Hagen but apparently without descriptions, as the latter merely quotes their names—*ida* and *iris*, in his paper. Thus the genus at the date of Hagen's paper was without genotype, as both *ida* and *iris* were nomen nudum.

In the following year Brauer republished the Hagenian description, giving *iris* as genotype, but again without descriptions (*Ibid.*, 18, pp. 370, 742 [1868].)

Up to the year 1871, *Zygonyx* was mistaken for a Corduline genus, firstly because of the similarity of the claws to *Macromia* and secondly on account of their Corduline, metallic colouring. Selys corrected this error in his *Synopsis des Cordulines* (p. 81, Sep., 1871), by pointing out that the hindwings were rounded at the base in both sexes, that the tibiæ were without keels, and the venation was of a Libelluline type.

Considerable doubt exists as to whether *ida* or *iris* is the correct genotype. Brauer in 1868 had mentioned *iris* as such, but as has already been pointed out, the name was a *nomen nudum*. Selys in 1868–1869 (*Ann. Soc. Ent. Belg.* xii, p. 96) gave *ida* as type, noting at the same time that Brauer had chosen *iris*. In the year 1891, Selys published the descriptions of both species for the first time (*Causeries Odonatologiques*, No. 4) mentioning no genotype, but giving preference of description to *iris*, so that it would appear that he had finally accepted Brauer's ruling. Kirby (*Cat. Odon*, p. 184 [1890]) gave *iris* as type, and I think that we may accept it as such. *Ida* and *iris* however belong to two different groups, so that, if in the future, they should be placed in different genera, this matter of the correct genotype will assume more importance.

In the last revision of the genus, Dr. Ris lists only three species, suppressing *ceylanica* Kirby, *aenea*, Kirby and *insignis*, Kirby as all synonyms of *iris*. To these three species, I have to add a fourth—*davina*, a beautiful species from Sikkim, and as will be seen in the sequel, with much more material at my command, I have to split up *iris* into a number of well-defined geographical races, or as I prefer to treat them, subspecies.

My species *Z. isis* from Coorg, S. India, turns out to be a *Pseudomacromia*. Dr. Ris with his usual acumen notes that my description tallies closely with that of *P. torrida*, and after having re-examined *isis*, I have to confess that very little separates the two species. *Pseudomacromia* up to now has been considered a purely African genus, but *torrida* has been taken in Palestine apart from its African distribution. Dr. Ris states that the separation of *Zygonyx* and *Pseudomacromia* is an artificial one and dictated by geographical reasons. With the discovery of *isis* in a *Zygonyx* locality these reasons now break down and *Pseudomacromia* becomes merged in *Zygonyx*, the latter automatically becoming one of the largest genera in the subfamily *Libellulinæ*. It is to be noted that *isis* and *iris* compare more closely with each other than they do with *ida*, a fact which links the two genera more closely.

Species of the genus not only resemble the *Corduliinæ* in their facies but also in habits, which are remarkably like those of *Macromia*. They are submontane in distribution and are usually to be found patrolling a short beat on mountain streams. *Isis* agrees with *iris* in this habit, but unlike the latter, frequently indulges in long spells of hovering flight over the brinks of rapids. Both species, after emerging, are gregarious, and soaring to great heights, may be seen in vast numbers, both sexes mingling without indulging in sexual intercourse, and often in company with *Macromia* and *Azuma*.

They deposit their eggs in the deeper pools occurring in the course of their parent streams, and not even the terrific scouring of the monsoon waters dislodges the larvæ, from their original birth-places. I have seen exuvia clinging to rocks beneath high waterfalls, where a week before, it seemed inconceivable that any living organism could survive the rush and weight of water. This is explained by the shape of the larvæ, the ventral surface being very flat and broad, the dorsum sharply keeled and stream-lined, and rising steeply like the ridge of a tent. Apparently by applying the flattened ventrum to rocks, and possibly contracting the ventral plates, they exert a vacuum, limpet-like suction, which holds them firmly anchored.

They mate over streams, males patrolling ceaselessly, each to its own short beat, awaiting the advent of females. Linking up tandem-fashion, they then set off up-stream, looking and prying into every likely spot wherein to deposit the eggs. This found, the male releases the female, which then proceeds to deposit its ova in bunches on the surface of the stream. Meanwhile the male stands guard over its mate, furiously attacking and driving off any intruders irrespective of size or species.

SYSTEMATIC

Zygonyx iris, Selys.

The Selysian type comes from Panibas, Bengal, a locality which I have been unable to trace on any of the maps which I have consulted. Selys received it from Mr. Atkinson, and it is to be noted that all other specimens of *Odonata* sent by that collector, came from Shillong and Cherrapunji, Assam. Lately Mr. Marton of Edinburgh has received some specimens of *iris* from Shillong, so that it may well be that a mistake was made in the case of the locality of the type.

Dr. Ris discussing this species (*Cat. Coll. Selys*, *Libellulines*, xiv, pp. 815–823 [1912]) comes to the conclusion that on the evidence afforded by the venation of the wings, and the structure of anal appendages, leg armature and genitalia, he is unable to split it up into forms of any greater rank than varieties. I think however that if a variety of a species is found to be restricted to a particular locality, occurring in great numbers, and to be the sole representative of the species in that district, it may justly claim specific or subspecific rank. It is on this evidence that I venture to split up *iris* into seven subspecies. The form from Borneo is insufficiently described to form any opinion on, but will probably be found to form an eighth subspecies (Laid, Sar. Mus. Journ., ix. —*A Note on Some Bornean Odonata, with Description of a new species.*)

The three subspecies from Ceylon, South India and Tonkin respectively, are all conspicuous from their large size. The Ceylon, Upper Burma and Tonkin forms are distinguished by the total absence of the conspicuous sexual distinction mark on the dorsum of segment 7. I have been able to examine a large number of specimens of the Ceylon form *ceylanica*, Kirby, which is the sole representative of *iris* in Ceylon. All agree in their great size, extreme melanism, and unmarked abdomen. I have seen and collected great numbers, probably running into hundreds, of the form *malabarica* from South India, which is again the sole representative of *iris* in that district, and find that the markings in all, never vary in shape or extent and that in all, there is a conspicuous abdominal marking on segment 7. Here then we have an insular and a continental form separated by a narrow strip of sea, each with its own well-marked characters, never varying and never intermingling. Turning our attention to the north of India, we find an exact parallel in the case of *iris* from Bengal, and *isa* and *mildredae* from Upper Burma, where the former has conspicuous abdominal markings, the two latter with unmarked abdomen. All three forms are smaller than the two southern. I need not labour the point further.

Zygony iris iris, Selys.

Male. Abdomen, 36 mm. Hindwing 43 mm.

Head. Labium bright citron yellow, the midlobe black, as also the borders of the lateral narrowly; labrum blackish brown, anteclypeus yellowish brown, postclypeus yellow, frons and vesicle bronzed or metallic blue; occiput yellow.

Prothorax, brown.

Thorax dark metallic green marked with bright citron yellow as follows :—The middorsal carina narrowly, a moderately broad humeral stripe, a very broad midlateral stripe and the hinder half or more of the metepimeron.

Wings hyaline but enfumed throughout, especially at the apices, which are stippled with brown ; pterostigma black ; nodal index $\frac{9–17\frac{1}{2}}{12–11}\Big|\frac{16\frac{1}{2}–9}{12–11}$; trigones traversed, occasionally twice, inner costal angle of that of forewing about a right angle ; subtrigones in forewings 3-celled, 1 or 2 cubital nervures in forewings ; only a single row of cells between *Rs* and *Rspl.*

Abdomen black marked with yellow as follows :—Segment 1 very broadly on the sides, this area bearing a medial cuneiform spot of black, segment 2 with the middorsal carina rather broadly yellow, and the sides, on the lower part of which is a largish irregular spot of black, segment 3 similar to 2, but no lateral black spot, the yellow here tapering away apicad, segments 4 to 7 with the middorsal carina finely yellow, broadening on 7 to form an elongate spot which is narrow at the extreme base, broadens rapidly and then tapers to a fine point as far as the apical border of segment ; segment 8 with a minute spot situated laterally and near the base, remainder of abdomen unmarked.

Anal appendages black, inferior triangular, considerably shorter than the superiors, curled slightly up at the apex ; superiors cylindrical, a little dilated subapically and then tapering to a fine point, a large robust ventral spine situated close to apex, no ventral spines at base.

Genitalia marked broadly with black and yellow stripes. Lamina projecting prominently and perpendicularly to the long axis of abdomen, tapering to a blunt point ; hamules with short stout curled black hooks directed back and converging on each other, base tumid ; lobe very narrow, subacute, prolonged.

Legs black, anterior femora yellow within ; hind femora armed with a row of closely-set, minute but robust spines, with 3 to 4 longer ones at the distal end of limb ; claw-hooks as long as apex of claw, so that the latter appear as if bifid.

Distribution. Confined to North Bengal and Assam, in submontane areas. Type in the Selysian collection from Bengal. Several males from Shillong, Assam, August 2, 1925, in Mr. Morton's collection, one of which he has been kind enough to give me. *Z. iris* resembles *malabarica* by possessing a conspicuous identification mark on segment 7, but in *iris* the marking is smaller and differently shaped ; on the contrary other markings are more extensive than in *malabarica*.

Female unknown.

Zygonyx iris malabarica, sub-sp. nov.

Male. Abdomen, 41 mm. Hindwing, 46 mm.

Head. Labium bright gamboge yellow, the midlobe and borders of latera lobes narrowly black ; labrum glossy black ; anteclypeus citron yellow, postclypeus glossy black at the centre and along lower margins, bright citron yellow laterally, this colour extending upwards along both sides of frons and meeting as a narrow line along its lower border. Frons and vesicle dark metallic violet ; occiput black.

Prothorax blackish brown.

Thorax dark metallic bluish green (prussian blue) marked with yellow as follows :—A moderately broad humeral stripe bright citron yellow in its lowest part, where it forms a conspicuous rounded spot, clouded and almost obscured with dark brown above ; laterally a narrow irregular bright citron yellow stripe situated medially, and rather less than the hinder half of the metepimeron the same colour. Tergum spotted broadly with yellow.

Legs black, anterior femora bright citron yellow within, hind femora armed with a row of very closely-set, small, robust spines.

Wings hyaline, uncoloured, longer and narrower than in the genotype. Pterostigma black, equal in all wings, over 2–2½ cells ; 3 rows of discoidal cells in forewings ; trigones all traversed once, inner costal angle of trigone in forewing obtuse ; a single row of cells between *Rs* and *Rspl*, with occasional double cells ; nodal index $\frac{8–15\frac{1}{2}}{9–10}\Big|\frac{15\frac{1}{2}–9}{11–9}$; 2 cubital nervures in forewing, only 1 in the hind ; membrane brown, Abdomen black marked with citron yellow as follows:—Segment 1 pale brown changing to black on dorsum, 2 with a broad lateral stripe almost connected across the dorsum by a fine line at the jugal suture, a narrow basal triangular spot on dorsum, segment 3 with the dorsal carina finely yellow, broadening slightly at base, a broad lateral stripe tapering apicad and continuous with that on the second segment, segment 4 with a baso-lateral spot confluent with a fine basal ring, which latter is confluent with a fine line on the dorsal carina, this gradually lost as traced apicad; segments 5 and 6 with fine basal rings, that on 5 confluent with a fine line on the basal half of the dorsal carina, 6 has also a small middorsal isolated spot, segment 7 with a broad conspicuous dorsal marking on its basal two-thirds, abruptly and squarely constricted at its extreme base and broadening slightly towards the apex of segment. At the base of segment a fine annule confluent with a narrow ventrolateral obscure stripe which extends for half the segment. Segments 8 to 10 unmarked.

Anal appendages black, inferior hardly shorter than the superiors, triangular, curling slightly up at apex; superiors longer than in *iris iris*, the ventral spine more obtuse, smaller and situated further from the apex of appendage, finally 3 to 4 spines on under surface of base of appendages.

Genitalia. Lamina projecting perpendicularly to plane of abdomen, tapering to a blunt point, very prominent in profile; hamules stout and broad at base, hooks short, directed back and in, striped with yellow, hooks glossy black; lobe long and narrow, rounded at apex and coated with long golden hairs.

Female. Abdomen 40 mm. Hindwing 47 mm.

Very similar to the male, but larger and more robust, its markings similar but the humeral stripe citron yellow throughout; segment 2 with the middorsal carina conspicuously but narrowly yellow and forming a cross with the fine yellow line bordering on the jugal suture. Segment 6 without the middorsal spot.

Wings hyaline; nodal index $\frac{9\text{–}14\frac{1}{2}}{11\text{–}10}\Big|\frac{15\frac{1}{2}\text{–}8}{11\text{–}10}$; 2 rows of cells between *Rs* and *Rspl* especially in the hindwings; 2 to 3 cubital nervures in forewing, 1 in the hind.

Anal appendages small, conical, pointed, black. Vulvar scale inconspicuous (hidden from view in practically all specimens examined, by a mass of extruded eggs).

Distribution. Restricted to Southern India. Western Ghats below Bombay, Palni and Shevaroy Hills and lower hills bordering the Madras District near Chingleput. Extremely common in Coorg where a hundred or more may be seen at one time flying together in the air, often 300 to 400 ft. above river level. Differs from other species except *ceylanica*, by its large size and robust build, and by its restricted thoracic markings. It differs from all species except *iris iris*, by the large dorsal marking on segment 7, this marking broadening apicad in *malabarica*, tapering apicad in *iris*. Other smaller details in addition, also separate it from North Indian species. These differences are easily appreciated when the species is confronted with others.

Larva strikingly like that of an *Ictinus*, ashy grey to black in colour, the legs banded with black.

Head rather broad, eyes hemispherical, projecting markedly. Wing cases divergent, broad, extending analward as far as the level of the apex of segment 5.

Mask short and broad, of the usual Libelluline shape, extending back as far as the level of the first pair of legs. No teeth or dentations along the contiguous borders of the lateral lobes or opposing border of the midlobe, these borders fringed with very closely-set, short stiff bristles. Moveable hook short. Six to seven setæ along outer border of lateral lobes, a row of 7 to 8 setæ on body of lobe near joints of lateral lobes and two converging rows of 10 to 12 in each row, near centre of body of mask. Midlobe produced in a slightly blunt triangle at the middle.

Abdomen very broad and high, triangular in section, the sides sloping steeply upward to a prominent dorsal keel, which bears a series of long robust backwardly directed spines, one on each segment, rather long and angulate near the thorax, obtuse, more robust, and less angulated back near the anal segments. The last two segments with a long fine spine on each side, that on the last being twice the length of that on the penultimate segment.

Legs long and spidery, hind femora extending back to apex of segment 6, almost naked.

These larvæ equal in size that of *Ictinus apax*, and being very similar in general appearance, are apt to be mistaken for it.

Zygonyx iris ænea. (Kirby.)

(= *Aenea* and *insignis*, Kirby.)

I have re-examined Kirby's types in the British Museum. There are two males of *insignis* and a single pair of *ænea*, all males agreeing in thoracic and head markings, all without abdomen marked, and all of large size similar to the Ceylon and South India forms. The two forms, one from Hainan, and the other from Tonkin, are obviously of the same subspecies. The males are without the yellow humeral stripe, although faintly indicated by a brownish mark below. All four specimens are distinguished by having the apices of wings enfumed with brown as far as the outer end of pterostigma, and also by a dark brown basal marking to the hindwings, about 1 to 2 rows of cells deep, and extending half-way to the tornus.

The female, which may or may not belong to these males, has the abdomen marked somewhat as in *davina*, but in addition has on segment 7 a long narrow oval yellow spot extending from base to apex. The dorsal carina is finely yellow as far as segment 7. Whilst the males have the thoracic markings obscured more than in *ceylanica*, the female has them as broad and distinct as in *davina*.

Zygonyx iris ceylanica, Kirby

Male. Abdomen, 37 mm. Hindwing, 50 mm.

Female. Abdomen, 45 mm. Hindwing, 53-55 mm.

This species described by Kirby in 1905 (*Ann. Mag. Nat. Hist.* (7) v, p. 533) is given as synonymous with *iris* by Dr. Ris in *Cat. Coll. Selys, Libellulines*, 1911, it is however quite distinct and much more nearly related to *malabarica* than to *iris*. Its size is even larger and its markings even more restricted than in *malabarica* from which it has in all probability been derived. I note the following differences :—Size distinctly larger on an average, black bordering of lateral lobes very broad, only the basal part of these lobes yellow, anteclypeus and postclypeus and portion of frons above it entirely black, the extreme sides only of the postclypeus yellow, humeral stripe absent, only a small rounded yellow spot below, lateral stripes of thorax almost obscured by dark brown, only the hinder margin of metepimeron narrowly yellow. Anterior femora black within. Inner costal angle of trigone of forewing more obtuse than in any other species. Abdominal markings absent except for an obscure lateral stripe on segments 2 and 3. Anal appendages as for *malabarica* but the ventral spines more numerous and 2 or 3 small spines found on the apical ventral spine.

Distribution. Restricted to Ceylon, to submontane areas. Several males collected by Col. F. Wall, 13, ix. 24, Kandy, Ceylon. One pair from Haragama, Ceylon, 15, vii. 10. Laidlaw gives the dimensions of the female, this sex otherwise has not been described, but probably closely resembles the male. Type in the B.M.

Zygonyx iris mildredæ, sub-sp. nov.

Male. Abdomen, 36 mm. Hindwing, 41 mm.

Head. Labium bright citron yellow, the midlobe and borders of lateral lobes very finely black ; labrum glossy black ; epistome and face bright greenish yellow, clouded centrally with brown, especially along the lower border of the postclypeus ; frons and vesicle dark metallic violet ; occiput blackish brown ; eyes dark reddish brown. Prothorax brown.

Thorax dark metallic green marked with bright citron yellow, the middorsal carina finely, a narrow humeral stripe which is clouded with brown above, a broad lateral medial stripe and the hinder half of the metepimeron, Wings hyaline ; pterostigma black, that of hindwing distinctly smaller than the fore ; nodal index $\frac{9-16\frac{1}{2}}{11-10}\Big|\frac{16\frac{1}{2}-9}{11-10}$; 2 rows of discoidal cells in all wings ; trigones traversed once, inner costal angle of trigone of forewing obtuse; 2 cubital nervures in forewings.

Legs black, anterior pair of femora brownish. Hind femora armed with a row of very small, very closely-set spines and 4 or 5 longer distal ones.

Abdomen black, a trace of yellow on the middorsal carina of segments 1 and 2, and the carina very finely yellow on segments 5 to 7. Laterally the sides of segments 1 and 2 yellow along the ventral border.

Anal appendages and genitalia shaped very similar to those of *Z. iris.*

Female. Abdomen 40 mm. Hindwing, 46 mm.

Very similar to the male but the markings more extensive, and the body more robust, the abdomen stouter.

Epistome and face uniform bright citron yellow ; frons dark metallic green, vesicle dark metallic blue.

Thorax similar to the male but the yellow brighter, the humeral stripe better defined.

Abdomen black marked more extensively than in the male. The dorsal carina rather broadly yellow on segments 1 and 2, finely so thereafter as far as the apical border of segment 7. The sides of segments 1 to 3 rather broadly yellow, tapering away on the sides of 3.

Anal appendages short black conical. Vulvar scale scoop-shaped, with straight hinder border, not prominent in profile.

Wings hyaline but palely washed with yellow from the level of trigones to the apices ; all trigones traversed once ; nodal index $\frac{10-16\frac{1}{2}}{11-10}\Big|\frac{16\frac{1}{2}-10}{10-10}$.

Distribution. Maymyo, N. Shan States, Upper Burma. Five males and a single female collected by Col. F. Wall, after whose wife this fine new species is named. It is distinguished from *Z. isa* by the 3 rows of discoidal cells in the forewings (only 2 rows in *isa*), as well as by the facial and abdominal markings. The two last features also serve to separate it from *Z. iris* and *ceylanica*, whilst venational characters easily distinguish it from *Z. ida* and *ilia*. The absence of basal wing markings separate the female from *Z. davina* which it rather closely resembles in other respects. The clear apices of all wings distinguish it from *ænea* from Tonkin.

Zygonyxi iris isa, sub-sp. nov.

Male. Abdomen 37 mm. Hindwing 44 mm.

Head. Labium dark brown with a very large citron yellow spot on each lateral lobe ; labrum and epistome glossy black, a broad lateral yellow fascia on each side of face extending downwards from front, the latter and vesicle a beautiful metallic violet ; occiput brown ; eyes dark reddish brown. Prothorax brown.

Thorax metallic green on dorsum as far out as the humeral suture, which latter lies in a stripe of dull brown. Laterally two broad bands of green metallic separated by an equally broad belt of dull brown. Hinder border of metepimeron dull pale brown.

Legs black, the anterior pair of femora reddish brown, armed with 3 long spines at their distal ends.

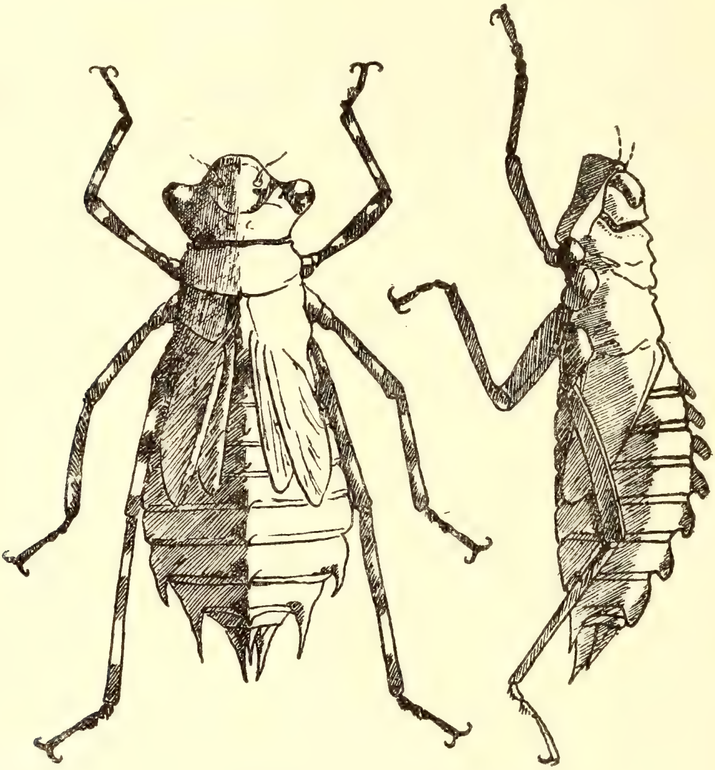
Wings hyaline ; pterostigma black, 3·5 mm. long in the forewing, 3·0 mm. in the hind ; membrane dark brown, the wing enfumed on its outer border ; 2 cubital nervures in forewing, 1 in the hind ; trigone of forewings traversed once, narrow, the costal side slightly longer than half the inner side ; trigone of hindwings traversed once ; 2 rows of cells between *Rs* and *Rspl* ; nodal index $\frac{9-14\frac{1}{2}}{9-10}\Big|\frac{14\frac{1}{2}-8}{9-9}$; *only 2 rows of discoidal cells in forewings.*

Abdomen black with dark green metallic reflex, the sides of segments 1 and 2 yellow, the dorsal carina and the base of segment 2 finely yellow. *The rest of abdomen black, unmarked.*

Anal appendages black, similar to those of *Z. iris.* Some minute spines beneath the superiors near the base and again near apex

Genitalia not differing markedly from *Z. iris.*

Distribution. Maymyo, N. Shan States, Upper Burma, collected by Col. F. Wall, I.M.S., June 19, 1924. The species closely resembles *ceylanica* in its absence of markings, but is distinguished from it by the broader markings on labium and thorax, and by the slightly broader and less inclined trigones of forewings, by its smaller size and more especially by the discoidal field of forewings formed of only 2 rows of cells instead of 3 (three rows in all other sub-species).



Larva of *Zygonyx iris malabarica*, Fras.

Zygonyx iris davina, sp. nov.

Female. Abdomen, 44 mm. Hindwing, 50 mm.

Head. Labium bright gamboge yellow, the midlobe and borders of lateral lobes narrowly black, labrum glossy black ; anteclypeus pale brown, postclypeus citron yellow, this colour extending up along sides of frons, the medial part glossy black ; frons and vesicle metallic green ; occiput black.

Prothorax matt black, posterior lobe small.

Thorax dark metallic green marked with citron yellow as follows :—The mid-dorsal carina narrowly, its upper part extending out as a narrow bar ; narrow humeral stripes slightly constricted above, and limited behind by the humeral suture, a broad lateral stripe extending between the two sutures, finally the hinder half of the metepimeron.

Legs black, anterior femora bright yellow within, armature of hind femora as for genus.

Wings hyaline, the apices enfumed brown in the forewing as far as a little proximal of middle of pterostigma, in the hind as far as distal end of pterostigma ; pterostigma black, sub-sequal in fore and hind-wings, over about 2 cells. Bases of all wings marked broadly with brilliant golden amber, in forewings as far as level of arc in the sub costal space, a little more distal behind

Cuii, and deepening in colour proximad ; in the hindwing as far as a little beyond the level of outer end of trigone in subcostal space, to outer end of trigone at level of that structure, and from thence in a curve towards the tornus. Discoidal field begins with 3 rows of cells for a distance of 5 cells and is then continued for a few cells as 2 rows ; trigone with inner costal angle about a right angle in the forewing, traversed once in all wings ; subtrigones 3 to 4 celled ; 2 cubital cells in forewings, 1 in the hind ; nodal index $\dfrac{11\text{–}17\frac{1}{2}}{15\text{–}12}\left|\dfrac{16\frac{1}{2}\text{–}12}{13\text{–}14}\right.$.

Abdomen black marked broadly with yellow as follows :—Segment 1 laterally, 2 almost entirely yellow, a narrow black subdorsal stripe broken broadly at the jugal suture and confluent with a narrow apical black ring, three similar to two but the black a little more extensive and coalescing over the dorsum at the apex of segment, four and five with the dorsal carina finely yellow, segment 4 has also a narrow stripe along the ventral border and a minute basal lateral spot. Rest of abdomen black.

Anal appendages black, small, conical. Vulvar scale inconspicuous, hinder border straight, not prolonged. (A cluster of eggs is found on this specimen, the individual eggs being oval in shape and pale yellow.)

Distribution. Pashok, Darjeeling District. A single female of this magnificent insect, collected by Mr. Chas M. Inglis at an altitude of 3,500 ft. May 24, 1925. It is distinguished at once from all other species by the broad coloured fascia at the bases of all wings, a marking which in colour and extent recalls that of *Anotogaster basalis* from the same district. Male unknown. It is to be hoped that more specimens and the male of this fine insect will fall to the net of Mr. Inglis.

Zygonyx ilia, Ris.

This species, like the following, belongs to an entirely different group and is distinguished by having the costal and proximal sides of the trigone in forewings nearly equal in length, and by the trigones of both wings entire. There is moreover only a single cubital nervure in the forewings (2 in all other species).

Zygonyx ida, Selys.

A small species from Java is distinguished by having only two rows of discoidal cells in the forewings, the trigones of forewings free (at least in the male, variably free or traversed in the female). The trigone of forewings is also much wider and shorter than in *iris*. The female has the apices of forewings pale reddish brown and the bases broadly golden yellow as far out as the middle of trigone, though not as deeply coloured as in *davina*. The body colouring, in both sexes, is coppery, marked broadly with yellow.

Zygonyx torrida isis, Fras.

As already stated above, this Coorg form cannot be considered more than a subspecies of *torrida*, the only species of *Pseudomacromia* with which I am at all acquainted

NOTES ON FISHES FROM BOMBAY

BY

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The fishes noted below were submitted to me by the Bombay Natural History Society in 1925. Though none are new to science several are of special taxonomic interest. Descriptive notes are also given of others with the idea of recording variation. The sequence of characters, formulas, etc., is the same as given in my late paper in South African Fishes.[1] The explanation in the introductory remarks of that paper will likewise apply here. The collection will be returned to the Bombay Society and with their permission a set of duplicates retained by the Academy.

EULAMIIDÆ

Scoliodon acutus (Rüppell.)

Two examples, 265 and 270 mm. They appear to agree with the example I described from Baram, British North Borneo.[2] They also agree with Day's figure. The back and upper surface nearly olive-gray and the lower surface creamy.

RHINOBATIDÆ

Rhinobatus rhinobatus (Linné.)

Disk width $1\frac{1}{8}$ its length ; snout rather broad, as seen from above profiles slightly concave and end rather broadly rounded, length about $2\frac{3}{4}$ in disk length ; eye equals space between interorbital ridges ; mouth nearly straight ; internarial space $\frac{4}{5}$ of nostril length, which $1\frac{7}{8}$ in mouth width ; spiracle nearly large as eye, with two papillæ on hind edge. Row of fine close-set tubercles, about fifteen over each eye and two over spiracle ; row of small close-set tubercles from middle of back to first dorsal, continued less distinctly between dorsals ; two groups of small tubercles at each shoulder ; scales very fine. Dorsals small, sub-equal.

Nearly uniform ecru-drab to vinaceous or light cinnamon above, with narrow lighter border all around disk and tail. Undersurface of body creamy, soiled with drab or pale brown.

Two examples, 253 and 263 mm.

TORPEDINIDÆ

Torpedo sinus-persici (Olfers.)

Disk sub-circular, length $1\frac{1}{10}$ its width ; snout short, much greater than interorbital, nearly straight across front profile as seen from above ; eye less than spiracle, 2 in level of interorbital ; mouth small, width $1\frac{3}{5}$ to $1\frac{2}{3}$ to front profile ; teeth small, in about twenty rows in each jaw ; internasal 1 to $1\frac{1}{5}$ in mouth width. Spiracle eye-diameter behind eye, with eight or nine fleshy marginal tentacles behind. Skin smooth. Dorsals small, inner angles rounded; origin of first before hind basal edge of ventral and base end well behind ventral base ; tail $2\frac{1}{3}$ in total length ; with small low fold each side ; hind caudal edge convex.

Nearly fawn-colour above, with large-dusky to dusky-black blotches, not sharply defined, close-set, more or less uniform and all nearly twice larger than eyes or spiracles. None extend in dorsals or caudal or have faded ? from caudal peduncle and also not very distinct on ventrals. Lower surface whitish, with light brown around edges of disk.

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[1] *Proc. Acad. Nat. Sci. Phila.*, 77, 1925, pp. 187–268.

[2] *Ibid.*, 1905, p. 458.

Two examples, 140 and 143 mm. compared with *Torpedo panthera* from Natal[1] the entirely different colour-pattern seems to be distinctive. This agrees with Garman's[2] description, though the figure by Sauvage[2] shows the spots much smaller and pale.

CLUPEIDÆ

Hilsa blochii (Valenciennes.)

Depth 3; head $3\frac{1}{3}$, width $2\frac{1}{8}$. Snout $3\frac{4}{5}$; eye 6, with broad adipose lids $1\frac{1}{2}$ in snout, $1\frac{1}{2}$ in interorbital; maxillary reaches opposite hind eye edge, with broad supplemental bone, length $2\frac{1}{5}$ in head, expansion $1\frac{1}{5}$ in eye; front of upper jaw well notched; interorbital $4\frac{1}{4}$ in head, convexly elevated; cheek deep, with fine vertical striæ; opercle finely, though obsoletely striate. Gill-rakers about 32 + 70, very slender, fine, much longer than gill filaments or equal snout.

Scales 42, of which last 4 in caudal base, 14 transversely, 15 predorsal; each with 6 to 9 transverse or vertical striæ; scutes 16 + 12; suprascapular region venulose. D. III, 14, I, first branched ray $1\frac{3}{5}$ in head; A. III, 17, I, first branched ray 4; caudal strongly forked, $3\frac{1}{4}$ in combined head and body; least depth of caudal peduncle $2\frac{3}{4}$ in head; pectoral $1\frac{1}{3}$, axillary scale $2\frac{1}{8}$ in its length; ventral $2\frac{1}{3}$ in head.

Black light olive, with deep blue and silvery reflections. Each scale above with dusky vertical streak terminally. Sides of head and body silver-white. Adipose region of eye pale. Fins all pale, front edge of dorsal and edges of upper caudal lobe grayish. Along upper side of back traces of 6 or 7 obscure neutral or dusky blotches.

One example, 320 mm. agrees with Day's figure of *Clupea kanayurta*.[3] Weber and Beaufort give the gill-rakers as 88 in an example 210 mm.

Ilisha indica (Swainson.)

Depth $2\frac{5}{6}$; head $3\frac{3}{4}$, width 2. Snout $3\frac{1}{2}$ from snout tip; eye 3, with adipose-lids, longer than snout or interorbital; maxillary reaches opposite first third of eye, with anterior ligament along front edge, $2\frac{1}{5}$ in head from snout tip; interorbital 6, but little elevated. Gill-rakers 12 + 24, lanceolate.

Scales 41, transversely 13, predorsal 16; each scale with 10 transverse vertical striæ, though only last complete; scutes 18 + 9. D. III, 13 ?, first branched ray $1\frac{3}{4}$ in total head length; A II, 36, I, first branched ray $2\frac{7}{8}$; least depth of caudal peduncle $2\frac{3}{5}$; pectoral $1\frac{3}{4}$; ventral $4\frac{1}{5}$.

Back olivaceous, sides and below bright silvery-white. Fins pale, dorsal and caudal dusted with grayish.

One example 250 mm.

SYNODONTIDÆ

Saurida tumbil (Bloch.)

Depth $5\frac{1}{3}$; head $3\frac{3}{5}$, width $2\frac{1}{10}$. Snout 5; eye $6\frac{1}{4}$, $1\frac{1}{4}$ in snout, $1\frac{2}{5}$ in interorbital; maxillary $1\frac{1}{2}$ in head; interorbital $4\frac{1}{2}$. Gill-rakers row of minute, uniform, close-set, numerous points.

Scales 52+4 in lateral line, slight keel along side of caudal peduncle, 5 above 6 below, 21 predorsal; scales with 2 to 10 basal, short, marginal striæ; circuli very fine, D. II, 10, I, first short branched ray $1\frac{1}{2}$ in head: A. II, 9, I, first branched ray $3\frac{1}{2}$; caudal forked, $1\frac{1}{3}$; least depth of caudal peduncle $4\frac{2}{5}$; pectoral $2\frac{1}{10}$; ventral $1\frac{2}{5}$.

Back brown, below soiled whitish. Iris yellowish-brown. Dorsal deep brown terminally, also caudal. Anal whitish. Paired fins largely dusky-gray, pectoral whitish or creamy basally.

One example, 300 mm.

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[1] *Proc. Acad. Nat. Sci. Phila.*, 1925, p. 193.

[2] *Hist. Nat. Madagascar, Poiss.*, 1891, p. 3, Pl. I.

[3] *Fishes of India*, 1878, p. 640, Pl. 162, Fig. 4.

Harpodon nehereus (Buchanan-Hamilton.)

Depth 6 ; head $4\frac{1}{5}$, width $3\frac{1}{5}$, snout $7\frac{2}{3}$ from snout tip ; eye $1\frac{1}{2}$ in snout ; maxillary $1\frac{1}{2}$ in head ; interorbital $4\frac{1}{4}$. Gill-rakers about 11 + 11 groups of small spines, of which enlarged one to each group.

Scales 40+8 in lateral line ; very thin and caducous ; circuli 7 to 21 + 18 to 26. D. II, 10, first branched ray $1\frac{1}{10}$ in total head length ; A. II, 12, first branched ray $1\frac{1}{2}$; caudal emarginate, with short median point, equals head ; least depth of caudal peduncle $5\frac{2}{3}$; pectoral to first third of dorsal base, $3\frac{4}{5}$ in combined head and body ; ventral reaches anal, or $3\frac{2}{3}$.

Upper edge of back heliotrope-purple, sides and below vinaceous-buff. Tail dusted with brown. Dorsal, anal and caudal dusted brownish, other fins pale.

One example, 242 mm.

PLEURONECTIDÆ

Pseudorhombus russellii, Gray.

Depth $1\frac{4}{5}$ to $1\frac{7}{8}$; head 3 to $3\frac{1}{6}$, width $4\frac{1}{8}$ to $4\frac{2}{5}$. Snout tip to lower eye $4\frac{1}{2}$ to 5 in head from snout tip ; lower eye 4 to $4\frac{1}{5}$; maxillary $2\frac{2}{5}$ to $2\frac{1}{2}$, expansion $1\frac{4}{5}$ to 2 in lower eye, reaches opposite middle of lower eye. Gill-rakers 8 + 15, lanceolate, slender, little shorter than gill-filaments.

Scales 65 to 67 in lateral line to caudal base, arch $2\frac{1}{6}$ to $2\frac{1}{3}$ in straight section ; 15 or 16 scales above arch, 29 or 30 below straight section ; row of fine scales on membranes of dorsal and anal between each fin ray and fin bases also scaly ; scales of left side with 10 to 14 basal radiating striæ, apical denticles 25 to 28, with 2 or 3 transverse series of basal elements and circuli fine. D. 66 to 69, height $2\frac{1}{2}$ to $2\frac{3}{5}$, in total head length ; A. 51 to 53, height $2\frac{1}{3}$ to $2\frac{7}{8}$; caudal pointed medially behind, $1\frac{1}{3}$ to $1\frac{2}{5}$; least depth of caudal peduncle $2\frac{4}{5}$ to 3 ; pectoral $1\frac{3}{5}$ to $1\frac{2}{3}$; ventral $2\frac{2}{3}$ to $2\frac{4}{5}$.

Left side drab-gray, marked with variable, scattered, darker rings, none larger than eye. Iris grayish. Fins pale gray-brown, with dark, scattered, irregular, variable spots. Pectoral and ventral grayish. Right side whitish, dark spots on vertical fins showing pale in terminal portions. Paired fins whitish.

Seven examples, 115 to 137 mm.

SOLEIDÆ

Cynoglossus macrolepidotus (Bleeker.)

Depth 4 to $4\frac{2}{5}$; head $3\frac{3}{4}$ to $4\frac{1}{8}$, width $4\frac{2}{3}$ to 6. Snout to upper eye $2\frac{1}{2}$ to $2\frac{3}{4}$; upper eye $9\frac{1}{2}$ to $11\frac{1}{4}$, advanced nearly half its diameter from lower eye ; mouth-cleft $4\frac{2}{3}$ to $4\frac{3}{4}$, moderately arched, rictus reaches little beyond lower eye, lips moderate. No gill-rakers.

Scales 55 to 57 in median lateral line to caudal base, 8 above median to upper, 11 below to lower body edge ; no lateral line on right side ; left scales with 61 to 70 basal radiating striæ, apical denticles 38 to 44 with 7 or 8 transverse series of basal elements and circuli minute ; right scales with 61 to 66 basal radiating striæ ; scales small on head, along body edges and out over caudal basally, forming low basal sheaths to dorsal and anal. Dorsal 113 to 115, height 4 to 5 in head ; A, 84 to 92, height $3\frac{1}{2}$ to 5 ; caudal $2\frac{1}{10}$ to $2\frac{1}{5}$, pointed.

Left side mummy-brown, each scale with vertical brown bar subterminally. Irides slaty. Vertical fins with deep brownish terminally. Right side uniform cream-white.

Two examples, 278 mm

SPHYRÆNIDÆ

Sphyræna barracuda (Walbaum.)

Depth $5\frac{3}{4}$; head $2\frac{7}{8}$, width 3. Snout $2\frac{1}{4}$ from snout tip ; eye $4\frac{7}{8}$, $2\frac{1}{5}$ in snout, greater than interorbital ; maxillary reaches $\frac{4}{5}$ to eye, expansion 3 in eye, length $2\frac{2}{5}$ in head from snout tip ; lower teeth vertically erect ; interorbital $5\frac{2}{5}$; preopercle ridge obtuse or rounded. Gill-rakers 2, short, lanceolate points, on lower branch of first arch.

Scales 78 + 9, 8 above to soft dorsal origin, 10 below, 23 predorsal to occiput. D. V.—II, 6, second spine $2\frac{1}{2}$ in total head length, first branched ray

3 ; A. II, 7, first branches ray $3\frac{1}{8}$; caudal $1\frac{7}{8}$, forked ; least depth of caudal peduncle $4\frac{1}{5}$; pectoral $2\frac{1}{3}$; ventral $2\frac{4}{5}$.

Back brown, lower sides and under surface silvery-white, Iris largely silvery. Dorsals and caudal brownish, other fins whitish.

One example, 275 mm.

POLYNEMIDÆ

Polydactylus plebejus (Broussionet.)

Depth 3 to $3\frac{2}{5}$; head 3 to $3\frac{1}{4}$, width $2\frac{1}{6}$ to $2\frac{1}{4}$. Snout $5\frac{4}{5}$ to 6 ; eye $4\frac{1}{4}$ to $4\frac{2}{5}$, greater than snout, $1\frac{1}{10}$ to $1\frac{1}{8}$ in interorbital ; maxillary from its own tip $1\frac{7}{8}$ to 2 in head from snout tip, expansion $1\frac{1}{2}$ to $1\frac{4}{5}$ in eye ; interorbital $4\frac{1}{5}$ to $5\frac{1}{3}$, broadly convex. Gill-rakers 10 + 15 lanceolate, longer than gillfilaments or $1\frac{1}{5}$ in eye.

Scales 55 to 62 + 17 to 20, 8 above, 11 or 12 below, 32 to 34 predorsal. D. VIII—I, 13, I, third spine $1\frac{1}{2}$ to $1\frac{3}{5}$ in head, first ray $1\frac{1}{2}$ to $1\frac{3}{5}$; A. II, 11, second spine $3\frac{4}{5}$ to 5, first ray $1\frac{7}{8}$ to 2 ; caudal deeply emarginate, upper lobe longer, $2\frac{2}{5}$ to $2\frac{4}{5}$ in combined head and body ; least depth of caudal peduncle $2\frac{1}{8}$ to $2\frac{1}{5}$ in head, pectoral $1\frac{1}{3}$ to $1\frac{2}{5}$, with 5 filaments, upper longest and reaches little beyond ventrals but not to anal ; ventral 2 in head.

Olive-brown above, paler to whitish below. Dorsals neutral-black terminally and anal dusted with neutral terminally. Hind caudal edge dusted narrowly with neutral dusky. Pectoral largely neutral-black. Ventral whitish.

Three examples, 228 to 278 mm. They agree with Günther's figure[1] except the dark longitudinal streaks are not evident in my examples.

Polydactylus sextarius (Bloch.)

Depth 3 ; head $2\frac{7}{8}$, width $2\frac{3}{5}$. Snout $5\frac{1}{3}$; eye $4\frac{2}{3}$, greater than snout, $1\frac{1}{4}$ in interorbital ; maxillary from tip $2\frac{1}{5}$ in head from snout tip, expansion 2 in eye ; interorbital $3\frac{3}{4}$ in head, broadly convex. Gill-rakers 16 + 19, lanceolate ; longer than gill-filaments or $1\frac{1}{2}$ in eye.

Scales 42 + 4 in lateral line, 6 above, 10 below, 15 predorsal ; basal radiating striæ 3, 86 small weak apical spines with 15 to 17 transverse series of basal elements and circuli very fine. D. VIII—I, 12, I, third spine $1\frac{2}{5}$ in head, first ray $1\frac{3}{4}$? A. II, 13, I, second spine $4\frac{2}{3}$, first ray 2 ; caudal deeply forked, $2\frac{1}{2}$ in combined head and body ; least depth of caudal peduncle $2\frac{1}{2}$ in head ; pectoral $1\frac{1}{2}$, filaments asymmetrical as 7 right and 6 left, extend back beyond depressed pectoral though not quite so far as tips of depressed ventral ; ventral $1\frac{7}{8}$ in head.

Body largely brown, with pale or dull yellowish tinge, especially below. On lateral line from third to sixth scale ellipsoid dusky or blackish blotch. Ends of dorsals and anals dusted with brown. Pectoral neutral-dusky terminally and ventral brownish terminally.

One example 250 mm.

CARANGIDÆ

Seriola nigrofasciata (Rüppell.)

Depth 3 ; head $3\frac{2}{5}$, width 2. Snout $3\frac{1}{10}$ from snout tip ; eye $4\frac{4}{5}$, $1\frac{2}{5}$ in snout, $1\frac{3}{4}$ in interorbital ; maxillary reaches opposite hind pupil edge, expansion 2 in eye, length 2 in head from snout tip ; jaw teeth in broad bands, simple, conic, outer row enlarged, in about 5 series ; no teeth on vomer or tongue ; interorbital 3, convex ; opercle with rather weak, fine, radiating striæ. Gill-rakers 1 + 8, short, low, strong, mostly rudimentary.

Scales about 90 in lateral line to caudal base, irregular, 16 above, 20 below, 25 predorsal to occiput ; 5 weak basal radiating striæ and complete circuli moderate. D. V—I, 32, I, third spine $5\frac{1}{10}$ in tota head length, first branched ray 2 ; A. I, 16, I, first branched ray $2\frac{2}{5}$; caudal deeply lunate, $4\frac{1}{8}$; least depth of caudal peduncle 5 ; pectoral $1\frac{3}{4}$; ventral $1\frac{1}{4}$.

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[1] *Journ. Mus. Godeffroy*, 4, 1875, p. 103, Pl. 77, Fig. A.

Dusky-brown generally, with grayish tinge on body above and under-surface soiled brownish. Back with 5 broad, rather oblique, obscure, dusky cross-bands. Fins largely dusky, tip of soft dorsal whitish. Pectoral pale brown. Ventral blackish. Iris brown, with yellowish tinge.

One example 240 mm.

Caranx djeddaba (Forskal.)

Depth $2\frac{7}{8}$ to 3 ; head $3\frac{3}{4}$, width $1\frac{4}{5}$ to 2. Snout $3\frac{2}{5}$ to $3\frac{3}{5}$ from snout up ; eye $4\frac{4}{5}$ to 5, $1\frac{1}{4}$ to $1\frac{2}{5}$ in snout, $1\frac{2}{5}$ in interorbital, adipose-lids broad ; maxillary reaches opposite front pupil edge, expansion $1\frac{2}{3}$ to 2 in eye, length $2\frac{3}{4}$ to $2\frac{4}{5}$ in head from snout tip ; single row of fine, uniform teeth in jaws, on vomer and palatines ; interorbital 3 to $3\frac{1}{8}$, convex ; preopercle flange with shallow radiating venules and opercle smooth. Gill-rakers 11+30, lanceolate, long, little shorter than gill-filaments.

Scales 35 to 37+43 to 45, arch 2 to $2\frac{1}{5}$ in straight section of lateral line, 10 or 11 scales above, 21 to 23 below ; scute depth equals eye ; breast densely scaled ; circuli 62 to 70, median axis more or less complete. D. I, VIII—I, 23, ɪ, third spine $2\frac{1}{3}$ to $2\frac{2}{3}$ in total head length, first ray $1\frac{9}{10}$ to 2 ; A. II—I, 18, ɪ to 20, ɪ, first ray $2\frac{1}{6}$ to $2\frac{1}{3}$; caudal widely forked, slender lobes pointed, equal head ; least depth of caudal peduncle $6\frac{1}{2}$ to $6\frac{3}{4}$; ventral $1\frac{7}{8}$ to $2\frac{1}{8}$; pectoral $2\frac{7}{8}$ to $3\frac{1}{3}$ to caudal base.

Back olivaceous or brown, sides and lower surface bright silvery-white. Large neutral-slaty blotch on opercle above but not on opposite side of gill-opening, nearly size of eye. Fins all pale, dorsals and caudal grayish terminally.

Two examples, 240 to 260 mm.

Caranx kalla, Valenciennes.

Six examples, 155 to 185 mm. These agree with examples from Portuguese East Africa, Calicut and the Philippines. The back has light greenish and bluish metallic reflections. All of lower surface bright silvery-white.

Carangoides malabaricus (Schneider.)

Five examples, 140 to 175 mm. Agree with Day's figure.[1]

Apolectus niger (Bloch.)

Depth $1\frac{1}{2}$ to $1\frac{2}{3}$; head $2\frac{4}{5}$ to $3\frac{1}{8}$, width 2 to $2\frac{1}{5}$. Snout 3 to $3\frac{1}{3}$ from snout tip ; eye $4\frac{1}{2}$ to $4\frac{3}{4}$, $1\frac{1}{3}$ to $1\frac{2}{5}$ in snout, $1\frac{1}{3}$ to $1\frac{1}{2}$ in interorbital ; maxillary reaches opposite eye, 3 to $3\frac{1}{8}$ in head from snout tip, expansion $2\frac{1}{4}$ to $2\frac{1}{3}$ in eye ; single band of fine, simple, conic teeth in each jaw, none on palatines or tongue ; interorbital convexly elevated, giving median ridge upward, $2\frac{1}{4}$ to $2\frac{4}{5}$ in head from snout tip. Gill-rakers 6+14, lanceolate.

Scales 85, with about 15 along lateral line slightly thickened or keeled ; sometimes single basal stria, circuli complete, 32 to 38. D. II, 43, ɪ or 44, ɪ, third branched ray 2 to $2\frac{7}{8}$ in combined head and body to caudal base ; A, II, 37, ɪ or 38, ɪ, third branched ray $2\frac{2}{5}$ to $3\frac{1}{8}$; caudal forked, $3\frac{1}{4}$ to $3\frac{1}{3}$; pectoral $2\frac{2}{5}$ to $2\frac{4}{5}$; least depth of caudal peduncle 5 to $6\frac{1}{2}$ in total head length ; ventral $2\frac{2}{3}$ in young.

Purplish-gray on back, young with 5 obscure, broad-dark vertical bands. Iris brownish. Dorsal and anal slaty. Caudal pale brown, edges of all vertical fins slightly dusky. Pectoral brownish.

Four examples, 112 to 168 mm.

LUTJANIDÆ

Lutjanus johnii (Bloch)

Depth $2\frac{1}{2}$ to $2\frac{3}{5}$; head $2\frac{1}{2}$, width 2 to $2\frac{1}{3}$. Snout $2\frac{4}{5}$ to 3 in head from snout tip ; eye $5\frac{1}{6}$ to 6, $1\frac{4}{5}$ in snout, equals or slightly greater than interorbital ; maxillary reaches opposite eye, expansion $1\frac{1}{3}$ in eye, length $2\frac{4}{5}$ to $2\frac{7}{8}$ in head from snout tip ; interorbital 5 to 6, convex.

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[1] *Fishes of India*, 1876, Pl. 50, fig. 2.

Scales 43 or 44 + 5 or 6, 7 above, 12 below, 13 predorsal to occiput, 6 or 7 rows on cheek. D. X, 14, I, fourth spine 4 in total head length, first ray $2\frac{7}{8}$ to 3 ; A. III, 8. I, second spine $3\frac{1}{10}$, first ray $2\frac{2}{5}$; caudal $1\frac{2}{5}$ to $1\frac{3}{4}$, little emarginate ; least depth of caudal peduncle $3\frac{1}{8}$ to $3\frac{1}{5}$; pectoral $1\frac{1}{3}$ to $1\frac{2}{5}$; ventral 2.

Pale brown generally, each scale on back and side with deeper brown spot. Lateral line with dusky blotch little larger than eye, largely above lateral line, below junction of spinous and soft dorsal. Fins all pale brownish.

Two examples 240 to 263 mm.

POMADASIDÆ

Pomadasis maculatus (Bloch.)

Depth $2\frac{4}{5}$ to $2\frac{5}{6}$; head 3 to $3\frac{1}{5}$, width $1\frac{7}{8}$. Snout $3\frac{2}{5}$ to $3\frac{1}{2}$; eye $3\frac{2}{5}$ to $3\frac{7}{8}$, equals snout, little greater or equals interorbital ; maxillary reaches opposite eye or front pupil edge, 3 in head ; interorbital $3\frac{7}{8}$ to 4 ; broadly convex.

Scales 50 to 54 + 6 or 7, 9 above, 14 or 15 below, 13 predorsal to occiput. D. XII, 14, I, fourth spine $1\frac{3}{4}$ to 2 in head, first ray, 2 to $2\frac{1}{3}$; A. III, 7, I, second spine $2\frac{1}{8}$ to $2\frac{1}{5}$, first ray $2\frac{1}{2}$ to $2\frac{2}{3}$; caudal $1\frac{1}{5}$ to $1\frac{1}{4}$, emarginate ; pectoral $2\frac{7}{8}$ to $3\frac{1}{4}$ in combined head and body ; ventral $1\frac{1}{3}$ to $1\frac{2}{5}$ in head.

Brownish on back with 2 rows of deep brown blotches, largely alternating as 2 lateral series along back. Sides and below whitish, whole body with silvered appearance. Iris pale. Spinous dorsal with large blackish median blotch. Soft dorsal broadly dusted dusky, medially whitish. Caudal brownish. Anal whitish, with dusky blotch in front.

Five examples, 139 to 160 mm.

Pomadasis hasta (Bloch.)

Two examples, 260 mm. These agree with those I reported from Calicut.[1]

THERAPONIDÆ

Therapon jarbua (Forskal.)

Depth 3 ; head $3\frac{1}{5}$, width $1\frac{4}{5}$. Snout $3\frac{2}{5}$; eye $4\frac{2}{5}$, $1\frac{1}{5}$ in snout, $1\frac{1}{3}$ in interorbital ; maxillary reaches opposite front eye edge, expansion $1\frac{3}{4}$ in eye, length $2\frac{3}{5}$ in head ; interorbital $3\frac{2}{5}$, broadly convex, little elevated.

Scales 80+3, 15 above, 27 below, 22 predorsal to occiput. D, XI, 10, I, fourth spine $1\frac{4}{5}$ in head, second ray $2\frac{2}{5}$; A, III, 8, I, third spine $3\frac{1}{3}$, second ray $2\frac{1}{4}$; caudal $1\frac{1}{8}$, emarginate ; least depth of caudal peduncle $2\frac{2}{3}$; pectoral $1\frac{7}{8}$; ventral $1\frac{1}{2}$.

Dull brownish above, whitish below. Back with 3 longitudinal deep brown bands, lowest median and paler, extends out on caudal medianly. Fins all more or less dull brown. Spinous dorsal with large blackish apical blotch, paler one posteriorly and soft dorsal with 2 deep gray blotches marginally. Upper caudal lobe with blackish tip and horizontal blackish blotch, lower lobe similar and dark tip less extensive.

One example, 218 mm.

SPARIDÆ

Sparus berda (Forskal.)

Depth $2\frac{1}{8}$; head $3\frac{1}{4}$, width $1\frac{7}{8}$. Snout 3 ; eye 4, $1\frac{2}{5}$ in snout, $1\frac{1}{8}$ in interorbital ; maxillary reaches opposite front pupil edge, $2\frac{2}{5}$ in head ; 6 conic canines in front of each jaw ; molars 3 series above, little anterior 4 irregular series, below 2 series and little anterior 3 irregular series ; interorbital $3\frac{3}{4}$, very slightly convex. Gill-rakers 3+9, short lanceolate.

Scales 46+7, 6 above, 13 below, 16 predorsal ; 5 rows on cheek to preopercle ridge, none on flange ; basal radiating striæ 10 to 13, apical denticles 42 to 58 with 3 to 8 transverse series of small, weak, basal elements and circuli fine. D. XI, 11, I, fourth spine $1\frac{3}{4}$ in head, first ray $2\frac{3}{5}$; A III, 7, I, second spine $1\frac{1}{2}$, first ray $2\frac{1}{8}$; caudal $1\frac{1}{8}$, emarginate, upper lobe little longer ; least depth of caudal peduncle $2\frac{2}{5}$; ventral $1\frac{1}{5}$; pectoral $2\frac{3}{4}$ in combined head and body.

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[1] *Journ.*, *Bombay Natural History Soc.*, xxx, No. 2, 1925, p. 319.

Dull brownish generally, under surface of both head and body paler to whitish. Each row of scales on back and side with median dull brownish band; on sides of head similar and following scales at longitudinal streaks. Deep brown blotch at suprascapula little larger than eye, conspicuous. Iris pale brown. Fins all brownish, membranes of spinous dorsal with some deeper brown.

One example, 163 mm.

Sparus spinifer (Forskal.)

Depth $1\frac{3}{4}$; head $2\frac{7}{8}$, width 2. Snout 2 ; eye 3, $1\frac{2}{3}$ in snout, 1 in interorbital ; maxillary reaches opposite front eye edge, $2\frac{1}{2}$ in head ; interorbital $3\frac{4}{5}$, broadly convex. Gill-rakers 7 + 10, short, lanceolate.

Scales 53 to caudal base, 7 above, 17 below, 20 predorsal, 5 rows on cheek. D. XII, 11, I, third to sixth spines end in long slender filaments reaching beyond caudal or equal combined head and body without caudal, first ray $2\frac{1}{5}$, in head ; A. III, 8, I, second spine $2\frac{1}{2}$, first ray $2\frac{7}{8}$; caudal $1\frac{1}{8}$, emarginate ; least depth of caudal peduncle $2\frac{1}{2}$; ventral $1\frac{1}{10}$; pectoral $2\frac{3}{5}$ in combined head and body.

Back pale brownish, below paler to whitish. Fins all pale brownish. Ventral and anal with little brownish medially and subterminally. Iris whitish.

One example 103 mm.

Gerridæ

Gerres filamentosus, Cuvier.

Depth $2\frac{1}{5}$ to $2\frac{1}{4}$; head 3 to $3\frac{1}{5}$, width 2 to $2\frac{1}{8}$. Snout 3 to $3\frac{1}{3}$; eye $3\frac{1}{4}$ to $3\frac{1}{3}$, equals snout, $1\frac{1}{8}$ in interorbital ; maxillary 3 in head, reaches little beyond eye front, well exposed, expansion $2\frac{4}{5}$ to 3 in eye ; interorbital $2\frac{3}{4}$ to $2\frac{4}{5}$ in head, convex, groove scaleless. Gill-rakers 6 + 7, short, lanceolate.

Scales 43 to 45 + 2 or 3, very caducous, 6 or 7 above, 10 or 11 below, 18 to 20 predorsal. D. IX, 10, I or 11, I, second spine prolonged filament reaching base of last soft ray, first ray $2\frac{1}{2}$ to $2\frac{7}{8}$ in head ; A III, 7, I, third spine 3 to $3\frac{1}{8}$, first ray 2 to $2\frac{3}{5}$; caudal forked, equals head ; least depth of caudal peduncle $2\frac{1}{2}$ to $2\frac{4}{5}$; ventral $1\frac{1}{3}$; pectoral $2\frac{1}{2}$ to $2\frac{3}{5}$ in combined head and body.

Back drab-gray, sides and below silvery-white. Iris silvery-white. Dorsals and caudal dusted gray, other fins whitish.

Three examples, 160 to 185 mm.

Sciænidæ

Otolithus ruber (Schneider).

Depth $3\frac{1}{3}$ to $3\frac{1}{5}$; head 3 to $3\frac{1}{8}$, width $2\frac{1}{8}$ to $2\frac{1}{4}$. Snout $3\frac{7}{8}$ to $4\frac{1}{8}$ in head from snout tip ; eye $4\frac{2}{3}$ to $4\frac{4}{5}$, $1\frac{1}{8}$ to $1\frac{1}{5}$ in snout, $1\frac{1}{8}$ to $1\frac{1}{4}$ in interorbital ; maxillary reaches opposite hind pupil edge, $2\frac{1}{5}$ to $2\frac{1}{3}$ in head from snout tip ; pair of wide-set upper canines and one symphyseal mandibular canine ; interorbital $3\frac{3}{4}$ to $3\frac{7}{8}$, broadly convex ; preopercle edge membranous. Gill-rakers 9 + 16, lanceolate, slender, equal gill-filaments.

Scales 59 to 62 + 7 to 10 along lateral line. Tubes 49 or 50 to caudal base, 8 or 9 scales above, 9 or 10 below, 30 to 32 predorsal ; 12 basal radiating striæ and circuli very fine. D. X or XI, 29, I or 30, I, second spine $2\frac{1}{5}$ to $2\frac{1}{4}$ in head from upper jaw tip, first ray $3\frac{1}{8}$ to $3\frac{1}{4}$; A. II, 7, I, second spine $5\frac{1}{2}$ to $6\frac{2}{5}$, second ray $2\frac{2}{3}$ to $2\frac{3}{4}$; caudal $1\frac{2}{5}$ to $1\frac{1}{2}$, obtusely angular behind ; least depth of caudal peduncle $3\frac{2}{5}$ to $3\frac{2}{3}$; pectoral $1\frac{1}{3}$ to $1\frac{3}{5}$; ventral $1\frac{2}{3}$ to $1\frac{7}{8}$.

Back brown, below whitish with more or less silvery reflections on head and body. Iris whitish. Spinous dorsal deep neutral-slate, little paler basally. Soft dorsal grayish, darker all along margins broadly. Caudal brownish. Anal whitish. Paired fins pale. Pectoral often with little brown above and deep neutral-gray in axil.

Four examples, 206 to 238 mm.

Johnius, Bloch.

Pennahia, new sub-genus.

Type. *Johnius æneus*, Bloch.

Body strongly compressed, rather short. Head well compressed, deep, bones somewhat cavernous. Eye large, mouth large, lower jaw protruding. Single row of large teeth in each jaw ; upper rather curved, well covered with lips, though front pair of wide-set canines largest; lower laterals largest and close-set, in front—anteriorly few small inconspicuous teeth. Gill-rakers lanceolate, long, 13 on lower limb of first arch. Scales little adherent in preserved examples. Caudal obtuse. Pectoral long.

Distinguished from sub-genus *Johnius* chiefly by the projecting mandible and increased gill-rakers.

(*Pinnah*, the Tamil vernacular.)

Johnius æneus, Bloch.

Depth 3 to $3\frac{1}{10}$; head $2\frac{7}{8}$, width $2\frac{1}{5}$. Snout $3\frac{3}{5}$ to $3\frac{4}{5}$ in head from snout tip, $1\frac{1}{5}$ to $1\frac{1}{3}$ in interorbital; maxillary reaches opposite hind pupil edge, expansion 2 to $2\frac{1}{2}$ in eye, length $2\frac{1}{8}$ in head from snout tip; interorbital $3\frac{1}{5}$ to $3\frac{1}{2}$, broadly convex; hind preopercle edge membranous. Gill-rakers 5 + 13, lanceolate, equal gill-filaments or longest $\frac{3}{5}$ of eye.

Scales 48 to 50 close along and above lateral line to caudal base, 45 to 47 tubular, 9 above, 9 below, 30 to 37 predorsal. D. XI, 23, I or 24 I, third spine $2\frac{2}{5}$ to $2\frac{1}{2}$ in head from snout tip, first ray $2\frac{4}{5}$ to $3\frac{1}{8}$; A. II, 7, 1, second spine 4, second ray $2\frac{3}{5}$ to $2\frac{7}{8}$; caudal $1\frac{2}{5}$ to $1\frac{1}{2}$, nearly truncate or very slightly concave-convex behind; least depth of caudal peduncle $3\frac{7}{8}$ to 4; pectoral $1\frac{1}{3}$; ventral $1\frac{3}{4}$ to $1\frac{9}{10}$.

Back pale brown, sides and below bright silvery-white. Iris white. Fins pale, lower ones whitish. Spinous dorsal deep dusky-gray, soft dorsal with broad margin of deep brown dots and subbasal longitudinal narrow band.

Two examples 182 and 209 mm.

Sub-genus PSEUDOSCIÆNA, Bleeker.

Type *Pseudosciæna amblyceps*, Bleeker.

Differs from *Johnius* in having an enlarged inner row of mandibular teeth.

Johnius diacanthus (Lacèpède).

Depth $3\frac{1}{4}$ to $3\frac{1}{3}$; head 3 to $3\frac{1}{5}$, width 2 to $2\frac{1}{8}$. Snout $3\frac{4}{5}$ to 4; eye 5 to 6, $1\frac{1}{5}$ to $1\frac{3}{5}$ in snout, 1 to $1\frac{1}{8}$ in interorbital; maxillary reaches nearly opposite hind eye edge, expansion $1\frac{1}{8}$ to $1\frac{1}{5}$ in eye, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in head; row of upper large teeth exposed with closed jaws; enlarged inner row of mandibular teeth; 6 pores on lower mandibular surface; interorbital $4\frac{2}{3}$ to $5\frac{1}{4}$, broadly convex; preopercle edge denticulate. Gill-rakers 6 + 9, lanceolate, short, half of gill-filaments.

Scales 56 to 67 + 7 in lateral line, tubes 41 to 43 + 22 to 32, 8 or 9 above, 10 or 11 below, 38 to 40 predorsal; basal striæ 12 to 14, apical denticles 42 to 50 with 7 or 8 series of transverse basal elements and circuli very fine. D. XI, 22, I, or 23, I, third spine $2\frac{1}{5}$ to $2\frac{2}{5}$ in head, first ray $3\frac{3}{5}$, A. II, 7, I, second spine $2\frac{1}{4}$ to $3\frac{1}{10}$, first ray 2 to $2\frac{1}{2}$; caudal $1\frac{2}{5}$ to $1\frac{1}{2}$, obtuse behind; least depth of caudal peduncle $3\frac{1}{4}$ to $3\frac{7}{8}$; pectoral $1\frac{3}{5}$ to $1\frac{7}{8}$; ventral $1\frac{3}{4}$ to $1\frac{7}{8}$.

Soiled drab-gray generally, four slightly deeper, broad bands on back, within each 2 or 3 series of deep dusky blotches size of pupil. Iris yellowish. Dorsal pale, with 5 or 6 blackish blotches. Caudal similar, only blotches at 3 or 4 transverse irregular rows. Ventral neutral dusky. Paired fins same.

Eight examples, 190 to 280 mm. These much more coarsely spotted than in Bleeker's figure of *Pseudosciæna diacanthus*.[1]

Depth $2\frac{4}{5}$ to $3\frac{1}{2}$; head 3 to $3\frac{1}{4}$, width $1\frac{4}{5}$ to 2. Snout $3\frac{1}{4}$ to $3\frac{1}{3}$; eye $4\frac{1}{8}$ to $4\frac{3}{4}$, $1\frac{1}{5}$ to $1\frac{2}{5}$ in snout, equals interorbital; maxillary reaches midway or $\frac{3}{5}$ in eye, length from snout tip $2\frac{1}{6}$ to $2\frac{2}{5}$ in head; row of upper teeth each side exposed with closed jaws; inner row of enlarged mandibular teeth; 5 pores in lower mandibular surface; interorbital $4\frac{1}{5}$ to $4\frac{1}{3}$ in head, broadly convex; preopercle edge denticulate. Gill-rakers 4 + 9, short, rudimentary tubercles, greatly less than gill-filaments.

Scales 46 to 50 + 5 or 6 in lateral line, tubes 45 or 46 + 7 or 8, 5 or 6 scales above, 8 or 9 below, 24 to 26 predorsal; 9 or 10 basal radiating striæ, apical denticles 57 to 62 with 13 to 15 series of basal elements and circuli very fine. D. XI, 27, I to 30, I, third spine 2 to $2\frac{1}{8}$ in head, first ray 3 to $3\frac{1}{8}$; A. II, 7, I, second spine $3\frac{1}{4}$ to $3\frac{2}{3}$, third ray 2 to $2\frac{1}{8}$; caudal $1\frac{1}{6}$ to $1\frac{2}{5}$, rounded behind with lower median rays longest ; least depth of caudal peduncle $3\frac{1}{4}$ to $3\frac{2}{5}$; pectoral $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral $1\frac{2}{3}$ to $1\frac{4}{5}$.

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[1] *Atlas Ichth.*, 9, 1877. Pl. (5) 88, Fig. 2.

Drab-gray on back and sides, below white. Opercle neutral to slate-gray, diffuse marginally. Iris pale and spinous dorsal slate-gray. Soft dorsal and caudal pale brown, dusted with neutral-gray marginally. Pectoral and anal soiled whitish. Slate-gray blotch in pectoral axil just behind fin origin. Ventral whitish.

Sixteen examples, 164 to 268 mm.

Sub-genus JOHNIUS Bloch.

Type *Johnius carutta* Bloch.

Body moderately compressed. Head obtuse. Mouth inferior, lower jaw included. No enlarged inner row of mandibular teeth. Gill-rakers short, usually tubercles or rudimentary.

Johnius carutta Bloch.

Depth $3\frac{2}{5}$ to $3\frac{1}{2}$; head $3\frac{1}{4}$ to $3\frac{1}{2}$, width $1\frac{1}{2}$ to $1\frac{3}{5}$. Snout, $3\frac{2}{5}$ to $3\frac{3}{5}$; eye $4\frac{1}{4}$ to $5\frac{1}{4}$, $1\frac{2}{5}$ to $1\frac{1}{2}$ in snout, $1\frac{1}{3}$ to $1\frac{2}{5}$ in interorbital ; teeth on jaws in villiform bands, only upper outer row enlarged ; 5 pores on lower mandibular surface ; interorbital $3\frac{1}{2}$, broadly convex ; preopercle edge membranous. Gill-rakers $4 + 9$, short, low tubercles.

Scales 50 to 51 close along lateral line to caudal base, tubes 45 or $46 + 4$ or 5, 6 or 7 scales above, 10 below, 25 to 30 predorsal ; basal radiating striæ 8 to 12, apical denticles 0 to 22 with 8 transverse series of basal elements and circuli very fine. D. XI, 26, I to 29, I, third spine 2 in head, first ray $2\frac{7}{8}$ to $3\frac{4}{5}$; A. II. 6, I or 7, I, second spine $3\frac{3}{5}$ to $3\frac{7}{8}$, second ray $2\frac{1}{4}$ to $2\frac{2}{3}$; caudal $1\frac{1}{2}$ to $1\frac{4}{5}$, obliquely convex behind with lower median rays longest ; least depth of caudal peduncle $3\frac{1}{2}$ to $3\frac{4}{5}$; pectoral $1\frac{1}{4}$ to $1\frac{1}{3}$; ventral $1\frac{3}{4}$ to $1\frac{4}{5}$.

Back drab-gray with deep soiled appearance, undersurface white. Iris pale or yellowish-white. Lateral line with pale median streak, spinous dorsal slate-gray to blackish terminally, soft dorsal and caudal brownish, other fins pale, soiled with brownish.

Two examples, 150 to 230 mm. Known by its pale lateral line, obtuse snout and uniform villiform mandibular teeth.

Johnius glaucus (Day)

Depth $2\frac{4}{5}$ to $3\frac{3}{5}$; head $3\frac{1}{8}$ to $3\frac{1}{4}$; width $1\frac{3}{4}$ to 2. Snout $3\frac{1}{2}$ to $3\frac{3}{4}$; eye 4 to $4\frac{1}{3}$, $1\frac{1}{5}$ to $1\frac{1}{4}$ in snout, 1 to $1\frac{1}{10}$ in interorbital ; maxillary reaches opposite eye center, $2\frac{1}{5}$ to $2\frac{1}{4}$ in head ; 5 pores on lower mandibular surface ; mandibular teeth in villiform band, with inner posterior little larger ; interorbital $4\frac{1}{5}$ to $4\frac{1}{4}$, broadly though slightly convex : preopercle edge membranous. Gill-rakers 6 +12, very short, lanceolate.

Scales 47 to $50 + 5$ in lateral line, tubes 44 or $48 + 8$, 6 scales above, 8 below, 25 predorsal ; basal radiating striæ 7 to 9, apical denticles 18 to 35 with 10 or 11 series of transverse basal elements and circuli very fine. DXI, 27. I to 30, I, third spine $1\frac{3}{4}$ to 2 in head, first ray $2\frac{1}{3}$ to 3 ; A. II, 7, I, second spine $3\frac{1}{2}$ to $3\frac{3}{4}$, second ray $2\frac{1}{5}$; caudal $1\frac{1}{3}$ to $1\frac{1}{2}$, cuneate, rounded behind, lower medium rays longest ; least depth of caudal peduncle $3\frac{1}{4}$ to $3\frac{1}{2}$; pectoral $1\frac{1}{4}$ to $1\frac{2}{5}$; ventral $1\frac{3}{5}$ to $1\frac{4}{5}$.

Back vinaceous buff to buff below, with undersurface whitish. Iris pale. Spinous dorsal dusky or neutral-dusky terminally. Soft dorsal, caudal and anal brownish terminally. Paired fins pale, pectoral little darker terminally and above. Deep slaty-gray blotch in pectoral axil, close behind fin origin. Opercle neutral-slate.

Three examples, 173 to 203 mm. Known by its pale general colour, which yellowish-gray.

Seiæna dussumieri (Valenciennes.)

Depth $3\frac{1}{2}$ to $3\frac{3}{5}$; head $3\frac{1}{8}$ to $3\frac{1}{5}$, width $1\frac{2}{3}$ to $1\frac{9}{10}$. Snout $3\frac{1}{4}$ to $3\frac{1}{3}$; eye $4\frac{2}{5}$ to 5, $1\frac{1}{3}$ to $1\frac{3}{5}$ in snout, $1\frac{1}{8}$ to $1\frac{2}{5}$ in interorbital ; maxillary reaches $\frac{2}{5}$ in eye or to hind pupil edge, from snout tip $2\frac{1}{2}$ to 3 in head ; front of snout below with pores and lower edge with 4 flaps along upper lip ; arc of 5 pores around lower symphysis of mandible ; symphyseal barb half of eye ; interorbital $3\frac{2}{5}$ to $3\frac{4}{5}$ in head, broadly convex. Gill-rakers 4+9, short tubercles, rudimentary. Scales 52 to 57 along laterel line to caudal base, tubes 43 to 47+5 or 6, 8 scales above, 10 to 12 below, 28 to 30 predorsal ; basal radiating striæ 10 to 12 and circuli very fine. D. XI, 23, I or 24, I, third spine, $1\frac{3}{4}$ to $1\frac{7}{8}$ in head, first ray $3\frac{1}{8}$ to $3\frac{1}{3}$; A. II, 7, I, second spine 3 to $3\frac{4}{5}$, third ray $1\frac{7}{8}$ to $2\frac{2}{5}$; caudal $1\frac{3}{5}$ to $1\frac{7}{8}$, obtuse, little obliquely rounded below ; least depth of caudal peduncle $3\frac{3}{4}$ to $3\frac{4}{5}$; pectoral $1\frac{1}{5}$ to $1\frac{1}{3}$; ventral $1\frac{4}{5}$ to 2.

Above generally bistre, with soiled or dark dusky appearance, also sides and generally that with silvery, violet and bluish reflections. Along back 4 or 5 obscure, ill-defined dark blotches and sides with dark cloudings. Dusky blotch, more or less conspicuous, about size of eye, at suprascapular region. Iris brown, spinous dorsal neutral-blackish. Soft dorsal, anal and caudal dark brownish. Paired fins pale basally, neutral-brown terminally.

Four examples, 144 to 217 mm.

DREPANIDÆ

Drepane punctata (Gmelin.)

One example 138 mm. Largely silvery, back with gray shade and traces of slightly darker-gray vertical bars.

OSTRACIONTIDAE

Ostracion gibbosus (Linné.)

Depth $1\frac{2}{3}$; head $3\frac{2}{5}$; carapace width $1\frac{3}{4}$. Snout $1\frac{1}{3}$ in head ; eye $2\frac{7}{8}$; interorbital $1\frac{4}{5}$, concave. Dorsal ridge with single compressed spine ; lateral ridge with 2 anterior spines at greatest width, posterior larger, besides 2 more subequal posteriorly ; suborbital spine broad. Gill opening long as eye. D. II, 8, entirely before anal, first branched ray $1\frac{4}{5}$ in head ; A. I, 8, second branched ray $2\frac{1}{10}$; caudal $1\frac{1}{5}$, little convex behind ; pectoral $1\frac{3}{5}$.

Pale brown generally. Base of dorsal dusky-brown. Deep brown blotch on spine of dorsal ridge. Brown blotch below pectoral base and one between each of 3 last lateral spines along lower edge of carapace superiorly. Also median lateral neutral brown area on body.

One example, 147 mm.

ON A COLLECTION OF MOTHS OF THE FAMILY *GEOMETRIDÆ* FROM UPPER BURMA MADE BY CAPTAIN A. E. SWANN

BY

LOUIS B. PROUT, F.E.S.

PART III

(*Continued from page 322 of this Volume.*)

* 139. *Asthena lassa*, sp. n.

♂, 24 mm. Near *A. anseraria*, H.-Sch. (*Syst. Bearb.*, vi. 134, Fig. 560), of the Palæarctic Region. Face of a more uniform brown. Antennal ciliation shorter.

Forewing with the brown lines fainter, rather thinner less macular, less deeply sinuous, the sub-basal and postmedian vaguely double, the distal postmedian terminating in a small blackish dot on hindmargin ; minuter dots at hinder end of distal subbasal and of antemedian.

Hindwing with termen slightly smoother than in *anseraria* ; cell-dot minute or obsolete ; lines feeble, rather thin, less deeply sinuous than in *anseraria.*

Underside similar to that of *anseraria.*

Htawgaw, April–May 1923 (type), June 1923 and August to September 1923, (paratypes).

140. *Pseudostegania plurilinearia* (Moore.)

Somatina plurilinearia Moore, *Proc. Zool. Soc. Lond.*, p. 645 (1867) (Darjiling).

Htawgaw, April–May 1923, 1 ♀ ; Hpimaw Fort, June 1923, 6 ♂♂, 3 ♀♀, 14–18 August 1923, 1 ♂, 1 ♀ ; Laukhaung, October 6, 1923, 1 ♂.

Distributed throughout the Himalayas, though rarer westward. Hampson sinks *unistirpis*, Butl., from Japan and Central China, which is at least racially separable. I believe the similar forms from West China are a race of the closely allied *denigrata*, Warr. (*Nov. Zool.* iii. 316), but I have not yet studied the group very closely.

* 141. *Poecilasthena burmensis*, sp. n. (Pl. I, Fig. 4)

♂, 26 mm. Extremely like *thalassias*, Meyr. (*Proc. Linn. Soc. N. Sth. Wales* (2) v. 813), from Australia. Antennal ciliation less minute.

Forewing with apex slightly more acute, termen slightly more oblique and less curved ; SC^5 stalked with SC^{2-4} considerably beyond apex of outer areole (in all the *thalassias* which I have examined from or close about the apex, but variation is frequent in these details) ; the white ground-colour less densely irrorated with sea-green (in *thalassias* generally justifying Meyrick's assumption of this as the ground-colour) ; the group of green lines which forms the postmedian slightly more oblique and more solidified into a band ; termen with some black-grey irroration which suggests a weak line, interrupted by white dots at and midway between the veins. *Hindwing* perhaps slightly narrower than in *thalassias*, the bend in midtermen rather more pronounced ; ground-colour and terminal line as on forewing.

Htawgaw, June 1923, the type only.

A very unlooked-for discovery, adding to the problem of the geographical range of the genus ; apart from its headquarters (South Moluccas, New Guinea, Australia and New Zealand) I had previously only seen a few examples from the Malay Peninsula (*thalassias*), where I assumed them to be an accidental importation, but this is clearly almost impossible for a remote fastness like Htawgaw.

* 142. *Autallacta subobliquaria* (Moore.)

Timanda subobliquaria, Moore, *Proc. Zool. Soc. Lond.*, p. 644 (1867) (Bengal).

Htawgaw, April–May, 1923, 1 ♂, 2 ♀♀; Hparè, September, 1923, 1 ♀; Hpimaw Fort, June 1923, 9 ♂♂, 3 ♀♀, July, 1923, 1 ♂, August 1923, 2 ♂♂, 1 ♀.

A common Sikkim species, but I think not previously recorded elsewhere.

143. *Hydrelia bicolorata* (Moore.)

Hyria bicolorata, Moore, *Proc. Zool. Soc. Lond.*, p. 642 (1867) (Bengal).

Htawgaw, April–May, 1923, 1 ♂.

* 144. *Hydrelia rufinota*, Hmpsn.

Hydrelia rufinota, Hmpsn., *Faun. Ind. Moths*, iv. 560 (1896) (Sikkim).

Htawgaw, April–May, 1923, 1 ♀; Hpimaw Fort, June 1923, 1 ♂, 9–13 August, 1923, 2 ♂♂.

* 145. *Hydrelia opedogramma*, sp. n. (Pl. I, Fig. 5.)

♂, 21 mm. Head and body white, the upper part of face suffused with brown. Antenna with minute ciliation. Femora and tarsi predominantly brown.

Forewing white, rather glossy; costal edge narrowly brown; some brownish suffusion between this and SC in median area, becoming much stronger in distal area; lines brown, very characteristically arranged, not at all dentate; a group of three proximally, acutely angulated about cell-fold, obsolescent anteriorly; a strong, almost straight postmedian pair; a broad subterminal and narrow terminal, meeting at both extremities, the intervening white line very slightly interrupted by feeble brownish shading on the veins; fringe brown. *Hindwing* with termen slightly flexuous; white; a fine straight median brown line, crossing DC at origin of R^2; a slightly thicker but not very sharp postmedian; subterminal and terminal a little thinner than on forewing.

Forewing beneath with the brown darker and more extended, embracing the entire costal area and entire cell, with some suffusion behind cell, and thickening all the lines, the postmedian pair becoming confluent, the terminal pair subconfluent. Hindwing with the lines—except the terminal—rather thicker and stronger than above.

Hpimaw Fort, June 1923, the type only.

* 146. *Hydrelia enisaria*, sp. n. (Pl. I, Fig. 23)

♂, 20 mm. Face blackish fuscous. Antenna with ciliation minute (less than ½). Thorax above dark fuscous; beneath, with abdomen, grey, indefinitely dark-marked.

Forewing broad, termen not very oblique; areole rather narrow, $S.C.^{1\cdot5\cdot2\cdot3\cdot4}$ stalked well beyond it; whitish grey; basal area fuscous, traversed by indistinct darkest lines; a very narrow, waved, dark-edged line of the ground-colour between this and the median band; median band rather broad, with blunt distal lobe in middle, fuscous (in parts with brighter brown shading), traversed by wavy darker lines and containing a large black cell-dot; band beyond rather broad, traversed by a weak fuscous line; subterminal bounded by fuscous lines or narrow shades; terminal line interrupted at veins; fringe weakly mottled. *Hindwing* with R^3-M^1 stalked; whitish grey, cleanest in the double outer band and at termen; cell-dot black, conspicuous; a faint wavy line just beyond, most observable posteriorly; postmedian line wavy, slightly dotted on the veins and ending in a black dot at abdominal margin; outer area much as on forewing.

Forewing beneath smoky, with the double outer band and terminal band indistinctly paler; hindwing nearly as above, but slightly weaker-marked.

Htawgaw, June 1923, the type only.

Near *nisaria* Christ. (*Bull. Mosc.*, iv (2), 49) from S. E. Siberia, Corea and Japan, possibly a race; slightly broader-winged, cell-dots stronger, forewing in median area and on underside darker, antennal ciliation perhaps slightly less vestigial.

* 147. *Discoloxia purpuraria* (Hmpsn.)

Hydrelia purpuraria, Hmpsn., *Faun. Ind. Moths*, iii. 413 (1895) (Nagas).

Htawgaw, March, 1923, 1 ♂, June, 1923. 1 ♂, 1 ♀, July, 1923, 1 ♂, 1 ♀, August 1923, 1 ♂; Hpimaw Fort, June 1923, 1 ♂, August 1923, 1 ♂, 9–13 August 1923, 1 ♂, 2 ♀♀, 14–18 August 1923, 3 ♂♂.

Slightly variable in size and tone, perhaps on an average larger and slightly more purple-grey (less purple-red) than Hampson's type. An interesting contribution to a little known species.

* 148. *Discoloxia nigrifurca*, sp. n.

♂ ♀, 27 mm. Face blackish grey. Palpus very short and slender; dark grey. Antennal joints scarcely so strongly projecting as in *obliquisigna*, Moore (*Lep. Coll. Atk.*, p. 278); ciliation about 1. Vertex, thorax and abdomen whitish grey, with slight irroration, the middle of thorax above slightly darker. Fore- and midleg partly infuscated, with the ends of tibia and of tarsal joints remaining whitish.

Forewing with Dc^2 less oblique than in *obliquisigna*, Dc^3 bending to become very oblique; whitish grey, with a slight lilacine tinge, the irroration faint; a number of shadowy brownish waved lines; a rather more distinct, slightly curved line bounding the small basal area; a black line from costa, along Dc^2 and Dc^3 to hinder angle of cell, throwing off, at the bend of Dc^3, a proximal furcation of rather variable length and intensity, but always obsolete posteriorly, or there represented by mere vein-dots, so that the black marks produce an inverted Y with short arms; postmedian line black, shaped much as in *lilacina*, Warr. (*Proc. Zool. Soc. Lond.*, 1893, p. 364, Pl. xxxii, Fig. 4), curving to run obliquely outward to hindmargin, thick from costa to M^1, very fine and slightly interrupted posteriorly; a warm brown line close beyond the postmedian and sharing its structure; some smoky shading beyond in anterior half of wing, traversed by a thick, ill-defined darker line; distal area again of the ground-colour; a dark terminal line, interrupted at the veins; fringe pale. *Hindwing* impure white, in distal half with indistinct grey lines, best marked on the veins; the true postmedian the strongest, with a slight outward projection about M^1 and inward bend to M^2; terminal line as on forewing or scarcely so strong.

Underside with forewing suffused, hindwing whitish; both with a cell-spot and postmedian line and some other weaker lines, or at least the two subterminals; terminal line rather weaker than above.

Hpimaw Fort, June 1923, 3 ♂♂, (including the type), 9-13 August, 1923, 1 ♂, 14-18 August, 1923, 1 ♂, 1 ♀.

* 149. *Leptostegna asiatica* (Warr.)

Dyspteris asiatica, Warr., *Proc. Zool. Soc. Lond.*, p. 358, Pl. xxxi, Fig. 8 (1893) (Sikkim).

Htawgaw, early July 1923, 1 ♀, August 1923, 2 ♂♂.

This species, although rare, seems to range from Sikkim to the mountains of West China. Hampson has erroneously sunk it to its Amurland congener *tenerata* Christ.

150. *Acasis viretata* (Hb.)

Geometra viretata, Hb., Samml. Eur. Schmett., Geom. t. 44, Fig. 230 (1798) (Europe).

Htawgaw, April–May 1923, 2 ♂♂; Hpimaw Fort, August 1923, 2 ♂♂.

The North Indian form has not yet, and the North American (*viridata*, Pack.) scarcely proved separable from the very widely distributed Palæarctic *viretata*. Even Capt. Swann's dates—though this is probably more coincidence—are exactly those at which British collectors would seek the two broods.

* 151. *Phthonoloba decussata* (Moore.)

Sauris decussata, Moore, *Proc. Zool. Soc. Lond.*, p. 655, Pl. xxxiii, Fig. 10 (1867) (Bengal).

Htawgaw, April-May 1923, 1 ♂.

Only previously known to me from Sikkim, Assam and Formosa, the latter apparently a differentiable race; Schultze (*Philipp. Journ. Sci.*, D, v. 176) adds Negros. Hampson's South Indian records belong to a separate species which I have described elsewhere (*Nov. Zool.*, xxxii. 43).

152. *Sauris fasciata* (Moore.)

Remodes fasciata, Moore, *Lep. Coll. Atk.*, p. 270 (1888) (Assam).
Htawgaw, August–September 1923, 1 ♂.

The specimen is wasted, but apparently agrees perfectly with this species, the only Indian one yet known of the subgenus (? genus) *Steirophora*, Warr. ; *olivacea*, Warr. and *normis*, Hmpsn., both sink to *fasciata*. Range : Sikkim to the mountains of Selangor.

* 153. *Sauris usta* (Warr.) (?)

Holorista usta, Warr., *Nov. Zool.* ii. 106 (1895) (Perak).
Hpimaw Fort, August 1923, 1 ♂.

Probably a new race of this species, but not in very fresh condition.

154. *Sauris ignobilis*, Butl.

Sauris ignobilis, Butl., *Ann. Mag. Nat. Hist.* (5), vi. 227 (1880) (Darjiling).
Laukhaung, April–May 1923, 1 ♂.

Subfam. GEOMETRINÆ

155. *Ourapteryx ebuleata* Guen.

Urapteryx ebuleata, Guen., *Spec. Gén. Lep.* ix. 32 (1858) (Kashmir). *Urapteryx kantalaria*, Feld., *Reise Novara, Lep. Het.* ii., t. cxxii., Fig. 3 (1875) (N.-W. Himalayas).

Laukhaung, April–May 1923, 1 ♂, July 1923, 2 ♂♂ ; Kangfang, June 1923, 1 ♂ ; Hpimaw Fort, June 1923, 1 ♂.

Probably confined to the Himalayas and their outliers (best known from Kashmir), but a group of closely similar forms awaits revision.

156. *Ourapteryx multistrigaria* Walk.

Urapteryx multistrigaria, Walk., List. Lep. Ins. xxxv, 1535 (1866) (N. Hindostan).

Fenshuiling Pass (four miles from), early July 1923, 1 ♂, 1 ♀.

This species, which differs from the preceding in its brown (not white) face, creamier wings, etc., is likewise best known from the Himalayas, but I believe occurs also in China and even Formosa.

157. *Myrteta ocernaria* Swinh.

Myrteta ocernaria Swinh., *Ann. Mag. Nat. Hist.* (6) xii. 152 (1893) (Khasis).
Shingaw, Hka Valley, January 13, 1923, 1 ♂.

A widely distributed Indo-Australian species. Probably the forms from the Moluccas and New Guinea may prove differentiable, but as far as Borneo and Pulo Laut there is very little observable modification.

*158. *Myrteta icuncula*, sp. n.

♂, 38 mm. Evidently very near *moupinaria*, Oberth. (*Et. Lep.* v (2) 32, Pl. lxxxviii, Fig. 858), which is only known to me from Oberthür's ♀ figure and almost worthless description ; perhaps a form. Differs in its smaller size, forewing with a conspicuous cell-dot, slightly more oblique and greyer postmedian line, rather better developed subterminal and traceable (highly oblique) antemedian, hindwing with termen slightly more bent, forewing beneath with strong cell-dot more strongly infuscated costal margin, a fuscous costal spot near apex and some irroration in cell, both wings beneath with the two lines slightly less obsolete. From *ocernaria*, Swinh., distinguishable *inter alia*, by the almost uniformly ochreous head (without the white lower half of face), blackish (not ochreous) antenna, greyer and much less sharp markings, rather more obliquely placed, without duplicating shade outside the postmedian, *similaria*-like underside of the ♂, obsolescence of the postmedian dots on SC^5 and R^1 and by the venation. In *ocernaria* the stalk of $SC^{1\cdot2}$ of forewing is connected or anastomoses with C ; in *similaria*, Swinh. (*Ann. Mag. Nat. Hist.* (8) xvi. 183, W. Sumatra) and its smaller, less angle-winged and more weakly marked replica *icuncula* SC^1 and SC^2 separate earlier and the former alone anastomoses with C. The hind tibia is dilated, though not so strongly as in *similaria*.

Htawgaw, undated, the type only. Hsipaw, North Shan States, allotype ♀ in coll. Brit. Mus.

The ♀, which was found mixed among *ocernaria* in the British Museum, does not seem to have had the subapical fuscous spot beneath, but is not perfectly fresh ; otherwise agrees fully.

* 159. *Myrteta fuscolineata*, Swinh.

Myrteta fuscolineata, Swinh., *Ann. Mag. Nat. Hist.* (6) xiv. 137 (1894) (Khasis).

Htawgaw, 4–10 April 1923, 1 ♀, April-May 1923, 1 ♀, early July 1923, 1 ♂.

Capt. Swann's three examples show considerable variation. The early ♀ has only the principal lines present, thus looking superficially a good deal like a small, poorly coloured *icuncula* ; the other ♀ is large and bright, with the supplementary (crenulate) lines all strong, the terminal line thick ; the ♂ is intermediate in markings, all the lines being discernible, but fine and rather weak. The species combines the face of *ocernaria* with the structure (venation) and hindleg) of *icuncula*, but has the hindwing less bent than either of them.

Swannia, gen. n.

Face smooth, nearly flat. Palpus rather short, densely scaled, third joint very small, not distinct. Tongue present. Antenna in both sexes nearly simple. Pectus moderately hairy. Femora scarcely hairy. Hindtibia rather slender, both pairs of spurs unequal. Wing-scaling iridescent. *Forewing* with costa scarcely arched, apex acute, minutely produced, termen almost straight, tornus pronounced ; cell about ½, DC straightish, subcostals crowded, $SC^{1\cdot2}$ long-stalked, their stalk anastomosing slightly with C, R^1 separate, R^2 slightly before middle of DC, M^1 stalked (sometimes only shortly). *Hindwing* with costa rather long, apex round prominent, termen almost straight, tornus sharp ; cell about ½, DC little curved, C approximated to SC to about ½ cell, then rapidly diverging, SC^2 just separate, R^2 wanting, M^1 stalked.

Type of the genus : *Swannia marmarea*, sp. n.

Presumably a derivative of *Myrteta*, but very distinct in shape and especially remarkable for the stalking of M^1 of both wings.

* 160. *Swannia marmarea*, sp. n. (Pl. 1, Fig. 16.)

♂♀, 34–36 mm. Face white, narrowly bright red-brown above. Palpus bright red-brown, first joint white beneath. Vertex and antenna bright red-brown. Body white, with a brown spot on shoulder. Foreleg red-brown on innerside. Midleg with a brown spot on knee.

Forewing glistening white, the iridescence predominantly bluish, in some lights with an admixture of pink ; sparse dark irroration visible with the lens ; costal margin bright red-brown, with some dark metallic scales behind ; a very minute blackish cell-dot ; a postmedian dot on SM^2 generally present ; fringe tinged with brown. *Hindwing* uniformly iridescent white ; fringe tinged with brown.

Underside similar, base of fringe darkened, hindwing with a rather thick dark terminal line, slightly interrupted at the veins, a little swollen between them.

Htawgaw, March 1923, 2♂♂, 2♀♀.

161. *Tasta argozana*, sp. n. (Pl. 1, Fig. 21.)

♂♀, 24–27 mm. Face brown-black, edged below with metallic blue or green. Palpus beneath pale brownish. Vortex brown-black. Thorax and abdomen dirty white, the latter above clouded with grey except at extremity. Legs whitish, tinged with brown, the anterior partly infuscated.

Forewing with SC′ generally free, occasionally anastomosing at a point with C ; white, tinged with pale brown, clearer at termen ; basal area sprinkled with metallic scales ; costal area in proximal half leaden-grey, sprinkled with metallic scales ; cell-spot roundish, dark-grey ; a grey median band immediately beyond or absorbing the cell-spot, copiously sprinkled with metallic (silvery or golden-tinged) scales ; a brown, somewhat scorched-looking costal patch at apex, rounded off behind, about reaching R^1 ; a subterminal row of metallic spots, on the apical patch receding slightly from termen ; fringe grey, tipped with metallic blue. *Hindwing* with the median band continued, its proximal edge shading off gradually basewards ; cell spot elongate, indistinct; subterminal shade anteriorly light-brown and narrow, posteriorly dark-mixed and broad, throughout marked with metallic scales, which generally form spots in the anterior cellules; on R^3 a small circular black ocellus, ringed with pale brownish; fringe as on forewing.

Underside dirty white, with the dark markings feebly suggested; fringes mixed with metallic blue.

Htawgaw, April–May 1923, 4 ♂♂, 1♀, June 1923, 4 ♂♂, 1 ♀, early July 1923, 1 ♂ (worn); Hpimaw Fort, June 1923, 2 ♂♂, 1 ♀, early July 1923, 2 ♂♂ (worn).

Hampson's differentiation (*Faun. Ind. Moths*, iii. 139, 140) of *Tasta* and *Bapta* by the condition of 'vein 11' is invalid, as this varies in both genera; but *Tasta* may be tenable on the strong metallic scaling. The Rev. C. R. N. Burrows has compared the genitalia and confirms the close relationship

162. *Bapta platyleucata* (Walk.)

Acidalia platyleucata, Walk., *List Lep. Ins.*, xxxv, 1628 (1866) (N. India).

Htawgaw, March 1923, 1 ♀, June 1923, 1 ♂, early July 1923, 1 ♂, Hpimaw Fort, June 1923, 6♂♂, 1♀, early July 1923, 2 ♂♂, 9-13 August, 1923, 1♂, 1♀.

Distributed from Afghanistan through North India to West China.

* 163. *Bapta aluta*, sp. n. (Pl. 1, Fig. 17.)

♂, 29–30 mm. Face and palpus dark brown, the face slightly rough-scaled, the palpus slender, with second joint appressed-scaled beneath, some scales above projecting forward. Vertex white. Thorax and abdomen white, irrorated above with grey. Fore and midleg partly infuscated.

Forewing rather short, termen very slightly curved, tornus pronounced; SC^1 free, SC^2 stalked, separating before SC^5; white, densely and pretty evenly irrorated with grey; costal edge narrowly ochreous; cell-mark darker grey, slightly elongate; lines weak, grey; antemedian excurved anteriorly; postmedian rather diffuse, recalling that of *platyleucata*, Walk., but more distally placed and more feebly incurved; subterminal thin, or only somewhat swollen about the veins, slightly less straight than in *platyleucata*, being a little curved behind middle; terminal line feeble, but sometimes developing slight vein-dots; fringe slightly mottled. *Hindwing* with termen a little straighter between R^3 and tornus than in *platyleucata*; cell-mark as on forewing or rather weaker; two very feeble lines or shades beyond, much as in *platyleucata* but with the first (the postmedian) much more curved or bent behind middle.

Underside glossy, unmarked, rather more brownish (or pinkish) white than in *platyleucata*.

Htawgaw, July 6, 1923, 2 ♂♂ (including the type), August 1923, 2♂♂. Assam, Cherrapunji, July 1893, 1 ♂ in Coll. Tring. Mus.

164. *Bapta alba* (Moore.)

Corycia alba, Moore, *Lep. Coll. Atk.*, p. 261 (1888) (N. India).

Hpimaw Fort, June 1923, 1 ♂.

Range: Sikkim to West China.

* 165. *Bapta ectiptica*, sp. n.

♂, 32 mm. Near the preceding. Face rather more black-grey (less brown), beneath paler, but not so definitely white at lower extremity as in *alba*. Wings slightly more elongate.

Forewing with costal and distal margins rather less curved; SC^1 anastomosing with C; cell-dot wanting; the two brown-grey lines fairly distinct; the thicker, less firm substerminal also developed; distal half fringe smoky. *Hindwing* with termen between R^1 and tornus straightish, the costal margin appearing relatively elongate (but apex well rounded); postmedian line fine, fairly strong, terminating rather nearer tornus than in *alba*; subterminal shade developed except costally; fringe as on forewing.

Underside much as in *alba* except for darkened tips of fringes; forewing with cell-dot nearly as strong as in that species; postmedian line fine and weak, pretty evenly developed throughout.

Htawgaw, April–May 1923, the type only.

166. *Bapta distans*, Warr.

Bapta distans, Warr., *Nov. Zool.* i. 404 (1894) ('Japan').

Htawgaw, July 1923 6, ♂♂, undated, 1 ♀; Hpimaw Fort, June 1923, 3 ♂♂.

Range: North-west India to West China. Warren's type was probably from the latter locality, as the species is not otherwise known from Japan and there is internal evidence that in the early days of the Tring Museum one consignment of Western Chinese species was erroneously labelled Japan. On the differentiation of *distans* from *alba* see *Seitz Macrolep.* iv. 315.

* 167. *Tanaoctenia haliaria* (Walk.)

Geometra haliaria, Walk., *List. Lep. Ins.*, xxii 518 (1861) (India).
Htawgaw, April–May 1923, 2 ♀♀, August–September 1923, 1 ♂,

* 168. *Nothomiza dentisignata* (Moore.)

Geometra dentisignata, Moore, *Proc. Zool. Soc. Lond.*, p. 636 (1867) (Darjiling).
Htawgaw, September–October 1923, 1 ♂.

* 169. *Nothomiza viridis* (Warr.)

Aplochlora viridis Warr., *Proc. Zool. Soc Lond.*, p. 386, Pl. xxxi, Fig. 7 (1893) (Sikkim.)
Htawgaw, September–October 1923, 1 ♂.
The specimen is discoloured to yellowish, a tendency not noticed in any of the long series of the following.

* 170. *Nothomiza ægriviridis*, sp. n. (Pl. 1, Fig. 2.)

♂ ♀, 25–29 mm. Face light reddish brown. Palpus short and slender; light brown. Vertex and base of antenna white; antenna simple. Thorax and base of abdomen above concolorous with wings; posteriorly and beneath white.

Forewing pale green, slightly variable, perhaps according to the degree of freshness; costal edge whitish; cell-dot black, extremely minute, sometimes scarcely discernible; terminal line brownish, extremely fine, not thickening anteriorly; fringe whitish, in proximal half tinged with cream-buff. *Hindwing* with termen weakly bent in middle; as forewing, but with cell-dot more distinct.

Htawgaw, August 22, 1922, 2 ♀♀, June 1923, 3 ♂♂, July 1923, 5 ♂♂, 4 ♀♀, August 1923, 6 ♂♂, 2 ♀♀

Perhaps a form of *obscuristrigata* Wehrli (*Iris.*, xxxvii. 66, t. 1. Figs. 7, 18), agreeing in size and shape, but without any trace of the lines or of the apical mark and probably of a duller grey-green hue. In any case different in colour from the greenish glaucous of Leech's *simpliciaria* (*Ann. Mag. Nat. Hist.* (6) xx. 239), the costal margin of forewing slightly less arched, termen rather less oblique, palpus perhaps not quite so heavily scaled.

* 171. *Nothomiza cinerascens* (Moore.)

Caberodes cinerascens. Moore, *Lep. Coll. Atk.*, p. 261 (1888) (Darjiling.)
Hpimaw Fort, June 1923, 1 ♀.

* 172. *Nothomiza ithyterma*, sp. n. (Pl. 1, Fig. 22).

♂, 36 mm. Closely related to *costalis*, Moore (*Proc. Zool. Soc. Lond.*, 1867, p. 616), nearly agreeing in size with its Khasi race *intensa*, Warr. (*Nov. Zool.* iv. 120). Head and body coloured as in that species, body above suffused with dark grey. Antennal teeth somewhat slenderer, pointed at the extremities.

Forewing with apex slightly less acute than in *costalis*, the ground-colour truncate in cellule 7 about 1 mm. from the apex, instead of running out to a point (commonly even produced to apex of fringe) as in *costalis*; pink, much suffused with dark grey, as in normal *formosa* Butl. or moderately suffused examples of *costalis*; the yellow costal edge underlined with bright red, especially in proximal ¼, this again by a very dark line or shade; the projection of the yellow into cell slight, not triangular; costal patch just outside cell larger than in average *costalis*, but not so large as in *formosa*; apical (terminal) yellow restricted, not reaching R^1; a hindmarginal patch of pink proximal to middle, about reaching M; less defined ones subbasally and tornally; the narrow dark area between subbasal and central pink patches rather accentuated, oblique, suggesting the end of a thick antemedian line. *Hindwing* with termen straighter from SC^2 to tornus than even in *costalis*; costal area white; the rest less clouded than forewing, but with the beginnings of dark subbasal and postmedian lines (very narrow bands) at abdominal margin ; termen and fringe dark.

Underside similar, but paler and more washed-out.

Htawgaw, March 20, 1923, the type only.

* 173 *Plutodes warreni*, Prout.

Plutodes warreni, Prout, *Ann. Mag. Nat. Hist.* (9) xi. 322 (1923) (N.-W. Himalayas).

Htawgaw, August 1923, 1 ♂.

P. warreni is now known to me also from Sikkim and the Khasis, though very much rarer in those localities than the allied *costatus*, Butl. The Htawgaw example and the only Khasi ♂ known to me are very dark, with the posterior terminal yellow mark of forewing narrowed.

174. *Peratophyga hyalinata* (Koll.)

Idæa hyalinata, Koll. in Hügel, *Kaschmir*, iv. 491 (1848) (Masuri).

Acidalia aerata, Moore, *Proc. Zool. Soc. Lond.*, p. 643 (1867) (Darjiling).

Htawgaw, April 4–10, 1923, 1 ♂ (ab.), July 1923, 1 ♀, August 1923, 1 ♀.

The ♂ is a brightly golden-tinted aberration with the dark bands not very strongly developed. The species, which is generally distributed from North-West India to West China, is everywhere variable and it is pretty certain that *totifasciata*, Wehrli (*Iris*, xxxvii. 66, t. 1, Figs. 6, 7) from Central and East China is a race of it, as is also not improbably the case with *venetia*, Swinh. (*Ann. Mag. Nat. Hist.* (7) ix. 416) from the Malay Peninsula, Borneo, etc. and perhaps *grata*, Butl. (*Ann. Mag. Nat. Hist.* (5) iv. 438) from Japan.

* 175. *Lomographa tenebrimedia*, sp. n. (Pl. 1, Fig. 18.)

♀, 24 mm. Head and body concolorous with wings. Hindtibia with the spurs extremely unequal, the inner of each pair being long, the outer vestigial.

Forewing with cell over $\frac{2}{5}$; the coincident subcostal (Sc^{1-2}) free ; reddish ochreous-brown, with dark irroration, the tone similar to that of *Pristostegania trilineata*, Moore (*Proc. Zool. Soc. Lond.*, 1867, p. 642) or a little darker , antemedian line obsolete ; postmedian pale ochreous, much as in *trilineata*, but less oblique than termen, posteriorly very faintly curved ; median, on the other hand, dusky, crossing a black cell-dot ; termen with minute dark interneural dots ; fringe slightly paler.-*Hindwing* with cell at least $\frac{2}{5}$; median shade just distal to cell dot ; postmedian almost parallel with termen.

Underside brighter, less irrorated ; cell-dots and median shade strong ; postmedian very indistinct, but followed at about 1 mm. distally by a narrow dark shade, which is moderately distinct on forewing, slight on hindwing ; terminal dots of forewing fairly large.

Laukhaung, March 10, 1923, the type only.

Superficially nearer to *Pristostegania trilineata* that to any other species which Hampson places in *Stegania* (*Lomographa*, Hb.), but with R^2 of forewing almost central, C of hindwing touching SC at a point, then diverging. It may be assumed that the ♂ will prove it to belong to the section *Heterostegane*.

* 176. *Chiasmia levata* sp. n. (Pl. 1, Fig. 20,)

♂, 19–23 mm. ; ♀, 23 mm. Group of *strigata*, Warr. (*Proc. Zool. Soc. Lond.*, 1893, p. 412, Pl. xxxi, Fig. 22). Face and palpus ochreous. Vertex pale ochreous, collar ochreous, thorax and abdomen white, more or less clouded with pale ochreous-buff and dotted and spotted with blackish.

Forewing with termen fully as oblique as in *strigata* ; white, with copious black irroration and strigulation, the ochreous suffusion much less strong than in *strigata*, chiefly represented in an oblique median stripe just outside the cell and a broader shade beyond ; black cell-dot much less large than in *strigata* ; lines macular, arising from enlarged costal spots, the postmedian more distally placed anteriorly than in *strigata* ; fringe sharply and almost regularly chequered. *Hindwing* in proximal half (or more) predominantly white, copiously marked with black-grey, distal part coloured more as in *strigata* but still somewhat paler and more variegated ; cell-dot almost as large as on forewing ; subterminal markings sometimes developed much as in *strigata*, sometimes weaker.

Underside similar, the ochreous shades slightly paler and more diffused, the dark strigulation in part coarsened.

Htawgaw, April–May 1923, 3 ♂♂ (including the type), August–September, 1923, 8 ♂♂, 1 ♀; Hparé, September 1923, 2 ♂♂; Blackrock, June 1923, 1 ♂ (worn); Hpimaw Fort, June 1923, 1 ♂.

Probably nearest to *pygmæaria*, Leech (*Ann. Mag. Nat. Hist.* (6) xix, 339), but weaker-marked. Varies very little; the second brood may be slightly brighter than the first and the Hpimaw Fort specimen seems to have the dark subterminal clouds enlarged, but is too wasted to be described in detail.

177. *Synegia suffusa* (Warr.)

Parasynegia suffusa, Warr., *Proc. Zool. Soc. Lond.*, p. 414 (1893) (Nagas).

Laukhaung, March 7, 1923, 1 ♂.

The specimen approaches *submissa* Warr. (*Nov. Zool.* i. 411, Khasis), which I take to be a form of this rather variable species; *erythra*, Hmpsn, to which Hampson (*Faun. Ind. Moths*, iii. 169) has sunk *suffusa*, is, however, distinct.

Range: India, South China, Formosa.

* 178. *Heterostegania nigrofusa*, Warr.

Heterostegania nigrofusa, Warr., *Proc. Zool. Soc. Lond.*, p. 415 (1893) (Sikkim).

Htawgaw, August 1923, 1 ♂.

The specimen is a modification—local or individual—of Warren's *nigrofusa*, larger, the median area less suffused, the distal more so, the dark postmedian patch much enlarged; still more unlike *lunulosa*, Moore, to which Hampson (*Faun. Ind. Moths*, iii. 170) has prematurely sunk it, than is Warren's type form.

* 179. *Heterostegania thamia*, sp. n. (Pl. 1, Fig. 10.)

♂♀, 36–38 mm. Face ochreous below, bright rosy above. Palpus light brown, second and third joints suffused with grey. Crown yellowish in front, bright rosy behind. Collar yellowish. Postorbital rim tinged with rose-colour. thorax and abdomen above yellowish, varied with roseate; ends of tegulæ and of patagia and base of abdomen bright rose; slight grey bands at ends of first few abdominal tergites; body beneath pale.

Forewing, as in the genotype, with SC^1 connected with C, SC^2 long-stalked with SC^{3-5}, anastomosing immediately (but shortly) with SC^1; pale yellow, very copiously irrorated or strigulated with rose-colour and more sparingly with dark grey, small, ill-defined spots of the ground-colour remaining in base of cellule 4 and as boundaries of the median area; cell-dot black; antemedian line obsolete; postmedian obsolescent, lunulate-dentate, incurved between the radials, marked with black interneural dots behind R^3; a narrow, very vague greyish shade shortly beyond the postmedian, connected with (or running into) an oblique anterior streak towards the apex; fringe pale yellowish, with slight rosy admixture and with black-grey spots opposite the veins. *Hindwing* concolorous, with similar cell-dot and postmedian and their attendant clear-yellow spots; an ill-defined dark-grey band or shade proximal to cell-dot; fringe as on forewing.

Underside pale buffy brown, irrorated and marked with dark grey; cell-dots black; postmedian macular, ill-defined, on forewing divaricating at R^3, the proximal branch running obliquely inward towards the proximal shade of hindwing (which is, however, obsolete anteriorly to SC, though strong behind) the distal meeting the postmedian of hindwing; terminal line indicated; fringes weakly spotted.

Htawgaw, August 1923, 1 ♂, 1 ♀.

A slightly paler ♂, with rather larger cell-dots beneath—perhaps a racial modification but not so perfectly fresh as Capt. Swann's examples—is in coll. Joicey from Hunan, Central China (Pratt).

* 180. *Crypsicometa homœma*, sp. n.

♂, 33-34 mm. Closely related to *incertaria*, Leech (*Ent. Supp.*, p. 49, 1891, Japan), possibly a race. Distinguished as follows:—

Forewing slightly narrower, more tinged with reddish, the colouring almost exactly as in *particolor*, Warr. (*Nov. Zool.*, iii. 128); costal and terminal lines finely black-brown; apical patch whiter, more regularly long-oval.—*Hindwing* more sharply bicoloured, with the postmedian line straighter (neither crenulate nor sinuous) but forming an excessively slight inward curve, thus closely approaching the cell-dot ; irroration on outer half more blackish, but so arranged as to leave almost clear a terminal patch between tornus and R^1, which is irregularly rounded proximally, about 3 mm. wide at its middle.

Htawgaw, early July 1923, 2 ♂♂.

* 181. *Hypochrosis tinctaria* (Walk.)

Decetia tinctaria, Walk., *List Lep. Ins.*, xxvi. 1522 (1862) ♀ [? N. India].
Marcala obliquaria, Moore, *Lep. Coll. Atk.*, p. 232 (1888) ♂ (Darjiling).
Laukhaung, July 1923, 1 ♂.

A rather small and rather dusky specimen, but not difficult to match from Sikkim or Assam.

Swinhoe (*Cat. Lep. Het. Oxf. Mus.*, ii. 241), who rightly criticizes Hampson's chaotic '*hyadaria*', considers that the present is the true *hyadaria*, Guen. Guenée's description, however, seems to me to point clearly to the larger, more fleshy-toned species which Walker described as *abstractaria* (*List Lep. Ins.*, xxvi. 1485, and again—apparently by oversight and on the same type-specimen—xxxv. 1559) and Moore as *irrorata* (*Lep. Coll. Atk.*, p. 232). *H. tinctaria* is perhaps the Indian (chiefly North Indian) race of a widely distributed species, represented on Ceylon by *chlorozonaria*, Walk (*List Lep. Ins.*, xxii. 554)=*galbulata*, Feld. (*Reise Novara, Lep. Het.* t. cxxxiii, Fig. 20), Sumatra, Borneo, etc., by *korndorfferi*, Snell. (*Tijd. v. Ent.* xx. 73), Celebes by *annulata*, Pagenst. (*Ent. Nachr.*, xxii, 52 ; *Abh. Senckenb. Ges.*, xxiii. 456.)

182. *Hypochrosis hyadaria*, Guen. (?)

Hypochrosis hyadaria, Guen., *Spec. Gen. Lep.* x. 537 (1858) (Central India).
Laukhaung, 23 July 1923, 1♂.

This specimen is an ab. (or possibly race) of a rather smaller, rather narrower form, with coarser or darker irroration, which I am strongly inclined to agree with Swinhoe in separating from true *hyadaria* (= *abstractaria*, Walk., *vide supra*), but which has as yet no legitimate name, Swinhoe having misidentified it as *ignivorata*, Walk. Walker's lost type of *ignivorata* (*List Lep. Ins.*, xxvi. 1754, Cherrapunji) was certainly, according to the description, the same species as his *abstractaria* (*hyadaria*). Both *hyadaria vera* and the present form (or relative) seem to be confined to North-east India and Burma ; 'Central India', with Guenée—as I have pointed out elsewhere—is known to have signified the region of Sylhet (!)

* 183 *Hypochrosis mixticolor*, Prout.

Hypochrosis mixticolor, Prout in *Seitz Macrolep.*, iv. 337, ft. 17 g. (1915) (Omei-Shan).
Htawgaw, June, 1923, 1♂.

* 184. *Hypochrosis eurynota* sp. n. (Pl 1, Fig. 14.)

♀ 39 mm. Face and palpus deep red, slightly mixed with black, palpus not so long as typical and rather more loosely scaled. Vertex and antennal shaft impure white ; pectinations about 3. Body, purple-reddish, the abdomen very robust, paler than the thorax.

Forewing with costa strongly shouldered near base, apex minutely produced, termen strongly oblique behind ; cell well over $\frac{1}{2}$; $SC^{1\cdot 2}$ shortly stalked, SC^1 anastomosing with C and later with SC^2 ; dull purple, irregularly shaded with dark-grey and white-grey ; costal edge mostly brighter purple-red ; base rather lighter and redder ; a minute whitish cell-dot ; a not very conspicuous red line (thicker and clearer anteriorly than posteriorly) from costa close to apex to hindmargin about 3 mm. from tornus, accompanied proximally by some ill-defined whitish maculation ; some whitish terminal shading behind apex ; fringe purple-red. *Hindwing* with termen slightly sinuous, tornus somewhat produced ; rather paler purplish ; a reddish, proximally dark-shaded postmedian line at $\frac{3}{4}$ abdominal margin and a broad dark-grey suffusion proximal thereto, all becoming obsolete about M^1 or R^2 ; fringe as on forewing.

Forewing beneath slightly paler than above, but with costal margin more broadly purple-red ; subterminal line obsolete, but with a broader purple-red patch marking its point of origin. Hindwing with the markings of abdominal region vaguely indicated.

Htawgaw, April 4–10, 1923, the type only.

In the rougher palpus, rather less robust wings, the prominent tornus of hindwing, etc., this species is not a typical *Hypochrosis* ; like *mixticolor* Prout, it suggests some possible affinity with *Phalæna*. There is, however, much minor structural variation within the genus as understood by Hampson, as also within the closely allied *Sabaria* (*Prionia* of Hampson) ; indeed my repeated attempts to find any constant morphological difference between the two, as arranged by that author, have hitherto proved fruitless and I am inclined to think that *Sabaria* will have to be sunk or the grouping recast. *H. mixticolor*, *eurynota* and the *muscicolor* group (*vide* infra) possess in common a fringe of long scales descending from the front of the fillet over the upper part of the face, a feature shared by some of the *Garaeus-Phalæna* group ; but I am not yet prepared to pronounce upon its distribution or its possible generic utility.

* 185. *Hypochrosis ancylotoxa*, sp. n.

♂, 30 mm. Face with minute tuft below ; red-brown. Palpus red-brown, the terminal joint darkened. Vertex light violet-grey, the fillet more whitish, its projecting scales (*vide supra*) rather long. Thorax and abdomen concolorous with wings.

Forewing closely like that of *H. muscicolor*, Warr. (*Proc. Zool. Soc. Lond.*, 1893, p. 407, Pl. xxxiii, Fig. 25), the coloration more ochreous-brown than in the figured ♀, but with slightly more vinaceous suffusion than in the ♂ described by Hampson (*Faun. Ind. Moths*, iii. 176) ; cell-dot white, a little larger than the black speck *muscicolor*. *Hindwing* with termen round-prominent at R^3–M^1, thin, strongly sinuous so as to form a rounded excavation behind M^2 and a pointed tornus ; costal area broadly whitish, the rest nearly concolorous with forewing, slightly more ochreous outside than inside the postmedian line ; cell-dot black ; postmedian straight, as in *muscicolor*, not bent as in *informis* Warr. (*Nov. Zool.*, iv. 120).

Underside similar or a little brighter ; cell-dot of forewing black.

Htawgaw, early July, 1923, the type only. (A ♂ from E. Pegu, 4,000–5,000 ft., March–April, 1890 (W. Doherty) and a ♀ from Bangkok, respectively in the Tring and the Hill Museums, evidently belong here and have developed the pair of spots outside the postmedian of hindwing, as in Warren's type ♀ of *muscicolor*, which is therefore not a sexual distinction. All three species of the group seem variable, but there is no evidence in the *Geometridæ* that such difference in shape could be other than specific.

* 186. *Anonychia grisea* (Butl.)

Nadagara grisea, Butl. *Proc. Zool. Soc. Lond.*, p. 172 (1883) [Simla].

Htawgaw, April–May, 1923, 1 ♀ ; Laukhaung, April–May, 1923, 1 ♂ ; Hparê, August–September, 1923, 1 ♂.

A fairly common mountain species from North-West India to West China. Everywhere more or less variable, but tending to become darker and more strongly marked eastwards.

* 187. *Anonychia diversilinea*, Warr.

Anonychia diversilinea, Warr., *Nov. Zool.* iv. 101 (1877) (Sikkim).

Htawgaw, April–May, 1923, 1 ♂.

* 188. *Anonychia latifasciaria*, Leech.

Anonychia latifasciaria, Leech. *Ann. Mag. Nat. Hist.* (6) xix. 225 (1897) (W. China).

Hpimaw Fort, September, 1922, 1 ♀.

The specimen is very worn but appears to be a rather dark, rather weakly marked form of this species rather than a form of its Indian relative *lativitta*, Moore.

* 189. *Heterolocha falconaria* (Walk.)

Aspilates falconaria. Walk, *List. Lep. Ins.*, xxxv. 1665 (1866) (N. India).

Htawgaw, June, 1913, 1 ♂, July, 1923, 12 ♂♂, 3, ♀♀ ; Hpimaw Fort, June, 1923, 1 ♂ ; Hparê, August–Spetember, 1923, 1 ♂.

Hampson only records this species from N.-W. India and Sikkim, but it is well known also from Bhutan and Assam.

* 190. *Heterolocha patalata*, Feld.

Heterolocha patalata, Feld., *Reise Novara*, *Lep. Het.*, t. cxxxii. Fig. 9 (1875) (Rampur, Himalayas).

Htawgaw, May–June, 1923, 1 ♀, undated, 1 ♂; Hpimaw Fort, August, 1923, 1 ♀.

Very variable; the Htawgaw ♀ is a fine bright green ab.

191. *Heterolocha segregis* sp. n. (Pl. ii, Fig. 2.)

♀, 33 mm. Head and body whitish drab, irrorated with dark grey. Palpus, as is *patalata*, Feld., very long, the terminal joint even somewhat longer than in that species. Antenna with minute ciliation.

Forewing with costa arched throughout, SC^1 from base of stalk of S.C.$^{2\cdot5\cdot3\cdot4\cdot}$, anastomosing with C; whitish drab, with rather sparse black-grey irroration and strigulation; a very small black cell-dot; proximal area weakly darkened, bounded by a narrow, bilobed, darker band; an equally narrow, very irregular outer band, chiefly expressed in a quadrate costal spot which reaches R^1, a larger spot between hindmargin and M^2 and a weaker more distal one between the radials; a narrow dark terminal border, tapering to a point at each end. *Hindwing* more whitish, with weak irroration; cell-dot very slight; postmedian band showing in a spot at abdominal margin; termen faintly and narrowly dark-shaded.

Underside more tinged with red-brown, especially on hindwing; irroration dark and coarse, especially on hindwing; markings of upperside indicated, the postmedian on forewing only distinct in the costal spot, on the hindwing, however, indicated throughout, sinuous; dark border of hindwing distincter and less narrow than above.

Htawgaw, beginning of July 1923, the type only.

192. *Loxaspilates obliquaria* (Moore.)

Aspilates obliquaria, Moore, *Proc. Zool. Soc. Lond.*, p. 649 (1867) (Sikkim).

Htawgaw, April 4–10, 1923, 1 ♂.

Range: Afghanistan, North India, West China.

* 193. *Opisthograptis molleri* Warr.

Opisthograptis molleri, Warr., *Proc. Zool. Soc. Lond.*, p. 403, Pl. xxxi, Fig. 12 (1893) (Sikkim).

Htawgaw, April–May 1923, 1 ♂, Hparé, August 1923, 1 ♂.

Previously known to me from Masuri, Sikkim and Assam.

* 194. *Opisthograptis swanni*, Prout (Pl. i. Fig. 13.)

Opisthograptis swanni, Prout, *Ann. Mag. Nat. Hist.* (9) xi. 314 (1923) (Hparé).

Hparé, August 29, 1922, the type ♂ only.

Throughout the collecting season of 1923, and especially when he revisited Hparé about the anniversary of its capture, Capt. Swann kept a vigilant look-out for further specimens of this very fine species, but without result.

* 195. *Corymica specularia* (Moore.)

Caprilia specularia, Moore, *Proc. Zool. Soc. Lond.*, p. 649, Pl. xxxiii, Fig. 11 (1867) (Bengal).

Hpimaw Fort, June 1923, 2 ♂♂, August 14–18, 1923, 2 ♂♂.

It is not at present safe to quote any localities beyond the North-east Himalayas as previously known for this species. Hampson (*Faun. Ind. Moths*, iii, 186) has, according to his wont, merged several distinct 'forms' (probably in part species) from South India, North-West India and Japan. Even Capt. Swann's captures may indicate a racial tendency, the 'apical patch' of forewing being still more 'obsolescent' than in the Sikkim form. One of the August specimens is a colour-aberration, more suffused with orange.

* 196. *Corymica immaculata*, Warr.

Corymica immaculata, Warr., *Nov Zool.* iv. 116 (1897) (Sikkim).

Htawgaw, early July 1 ♀, 1923.

A scarce species, previously only recorded from Sikkim and Bhutan.

* 197. *Xenographia adustata* (Moore.)

Epione adustata, Moore, *Lep. Coll. Atk.*, p. 229, Pl. viii, Fig. 20 (1888) (Khasis).

Htawgaw, April–May 1923, 1 ♂.

198. *Callerinnys obliquilinea* (Moore.)

Epione obliquilinea, Moore, *Zep. Coll. Atk.*, p. 229 (1888) (Darjiling.)

Htawgaw, June 2 ♂♂, 1923, August 1923, 1 ♂.

Range : Sikkim to Tonkin.

* 199. *Nadagara epopsioneura*, sp. n.

♂, 33 mm. Head, collar and tippets bright brown, somewhat reddish. Thorax, abdomen and legs more flesh-colour, weakly clouded with brown. Hindtibia not dilated.

Forewing rather narrow ; termen scarcely crenulate anteriorly, almost smooth posteriorly, obliquely curved ; reddish fawn-colour, with the veins darkened ; costal edge spotted and dotted with deep brown ; cell-dot moderate ; lines deep brown, finely edged on reverse sides with white ; antemedian from SC at $\frac{1}{3}$ to hindmargin at $\frac{1}{3}$, very strongly excurved but with no actual angle ; postmedian from costa about 3 mm. from apex, a little excurved at first, then almost straight to hindmargin nearer to antemedian than to tornus ; indications of an irregular whitish, proximally dark-shaded subterminal ; terminal line continuous. *Hindwing* with termen scarcely waved, a very slight (scarcely noticeable) excision between the radials ; costal area whitish ; the rest concolorous with forewing ; cell-mark slightly elongate ; postmedian line continued from forewing, almost straight ; traces of subterminal and its dark shading ; terminal continuous.

Underside (especially of forewing) rather more tinged with ochreous ; hindmarginal area of forewing pale ; both wings with grey strigulate, rather elongate cell-mark and slender postmedian and terminal lines, the postmedian of forewing as above, that of hindwing excurved anteriorly, straightish from R^3.

Laukhaung, March 10, 1923, the type only.

A ♀ from the Naga Hills, rather larger but otherwise identical, in Coll. British Museum.

* 200. *Luxiaria tephrosaria* (Moore.)

Acidalia tephrosaria, Moore, *Proc. Zool. Soc. Lond.*, p. 643 (1867) (Bengal).

Htawgaw, April–May 1923, 1♂, July 1923, 1♀, undated, 1♀.

The two ♀♀ belong to the common aberration with a roundish black postmedian spot on SM^2 of the forewing ; the ♂ lacks this spot.

Range : Kulu, Sikkim, Bhutan, Assam.

201. *Luxiaria mitorrhaphes*, Prout.

Luxiaria mitorrhaphes Prout, *Nov. Zool.*, xxxii. 64 (1925) (Nagas).

Htawgaw, June 1923, 1♀, early July 1923, 1 ♂.

The ♂ belongs to the aberration with an irregular black postmedian spot between M^2 and hindmargin of the forewing, analogous to the aberration of *tephrosaria* mentioned above. For a fuller discussion of the species of this group, see my article in the '*Novitates*' (xxxii. 62–64).

Range : Sikkim to West China, Formosa.

202. *Luxiaria amasa fasciosa*, Moore.

Luxiaria fasciosa Moore, *Lep. Coll. Atk.*, p. 254 (1888) (Darjiling).

Htawgaw, August 1923, 1 ♀.

I believe *amasa*, Butl. (*Ann. Mag. Nat. Hist.* (5) i. 405, Japan), *fasciosa* Moore, (N. India) and *fulvirascia*, Warr. (*Nov. Zool.*, i, 440, Sumatra) to be races of a single species, the first two, indeed, scarcely allowing of a rigid differentiation, as they seem to intergrade in West China and perhaps on Formosa.

* 203. *Krananda orthotmeta*, sp. n. (Pl. ii, Fig. 1)

♂, 40 mm. Head and body concolorous with wings. Foretibia blackened on innerside, tarsus in part spotted with black. Mid and hindleg marked with black, especially at the joints, the spurs, and on tarsi, the hindfemur and tibia each with a conspicuous spot in middle.

Forewing shaped nearly as in *oliveomarginata* Swinh. (*Ann. Mag. Nat. Hist.* (6) xiv. 139), the angle at end of R^3 rather stronger; SC^1 cannote with SC^{3-5} (probably variable, as in *oliveomarginata*); colouration much as in the palest, most ochreous-toned examples of that species; markings also similar, but weaker; postmedian line almost straight, the shade beyond somewhat rufescent, comparatively narrow, a great part of the terminal area being almost of the ground colour, merely a little more rufescent about the radials; some red-brown subterminal spots from costa to SC^5, in cellule 5 and from M^2 to hindmargin; fringe mostly tipped with black. *Hindwing* similarly with the tooth at R^3 accentuated; colour and markings much as on forewing; postmedian line less straight; fringe as on forewing.

Underside similar.

Hpimaw Fort, August 9–13, August 1923, the type only.

Quite near *oliveomarginata*, but with the paler tints and the straight postmedian line superficially recalling the very differently shaped *latimarginaria*. Leech (*Seitz Macrolep.* Pl. iv, 19 *b*).

* 204. *Loxotephria perileuca*, sp. n. (Pl. ii, Fig. 5).

♂, 27 mm. Closely related to *olivacea* Warr. (*Nov. Zool.* xii. 414). The pale, almost patternless areas (of forewing beneath and hindwing above) rather more extended, probably betokening a somewhat different resting posture. *Forewing* slightly narrower, darker, the white lines more sharply expressed. *Hindwing* with postmedian line less straight (narrowing and slightly curving, first outward and then inward, in approaching its anterior evanescence).

Laukhaung, July 1923, the type only.

* 205. *Semiothisa ageta*, sp. n. (Pl. ii. Fig. 15).

♂, 39 mm. Face with small cone of scales below; rufous. Palpus slightly over 1½; rufous, dark-mixed, at base pale-yellow. Vertex rufous. Antenna with fascicles of very long cilia. Thorax and abdomen pale yellow, in places slightly mixed with rufous. Legs pale, with patches of blackish scales at ends of tibiæ; hindtibia not dilated.

Forewing with termen faintly crenulate from apex to R^3, at R^3 slightly bent, thence almost straight; no true fovea, but SM^2 near base appreciably curved and thickened, the usual thinly-scaled patch behind it accentuated; SC^{1-2} coincident, connected by weak bar with C; pale yellow, very slightly irrorated with rufescent scales; slight dark marking at costa; a small black cell-dot; a thick, not very sharply defined, obliquely curved antemedian line not quite reaching the costa, bounding some very slight basal suffusion (exaggerated by photography); postmedian line almost straight; distal one-third bright red-brown, mixed in part with violaceous, containing some small ochreous spots (the rounded one between the medians more conspicuous than in the photograph) and a blackish cloud between R^3 and M^2 just outside the rounded spot; a fainter curved line running close to the postmedian between R^1 and M^1 but receding anteriorly and posteriorly; fringe rufous, with some glittering paler scales. *Hindwing* with apex almost rectangular, tail at R^3 strong; yellow in proximal half, bright brown, much suffused with violaceous, in distal; a faint dark postmedian boundary-line; cell-dot very minute; terminal area slightly dark-clouded in anterior half; a weak oblique brown half-line from tornus.

Underside similar, but with the yellow area rather more strongly and darkly speckled, the antemedian line of forewing grey, the postmedian of both wings less sharp than above, edged with brown proximally, the markings on the distal area a little strengthened.

Blackrock, June 1923, the type only.

The most gaily coloured *Semiothisa* yet known.

* 206. *Semiothisa khasiana* (Moore)

Gonodela khasiana Moore, *Lep. Coll. Atk.*, p. 262 (1888) (Khasis).

Laukhaung, March 10, 1923, 1 ♂.

The specimen is aberrant in some details, the most noteworthy of which—the slightly less obliquely placed antemedian of forewing—might suggest that it is a separate species ; but as the structure and most essential features agree I leave it here.

A fairly common North Indian species, with a Malayan race *vehemens*, Prout (*Nov. Zool.* xxxiii. 23).

* 207. *Semiothisa monticolaria* (Leech)

Macaria monticolaria, Leech, *Ann. Mag. Nat. Hist.* (6) xix. 308 (1897) ; *Seitz Macrolep.* iv, Pl. 18 f. (1915) (Omei-Shan).

Langyang, July 1923, 1 ♂.

A smaller, stronger-marked aberration or race. It is, however, just possible that the supposed species, of which Leech's type remains unique in the British Museum, is itself a strikingly differentiated form of the Indian *effusata*, Guen. (*Spec. Gén. Lép.* x. 87) ; the Langyang example would be in one or two respects slightly intermediate, though still very far from normal *effusata.*

* 208. *Semiothisa clivicola*, sp. n.

♂, 41 mm. Near the preceding species. Structure, so far as studied, the same, antennal joints not projecting, ciliation about 1, hindtibia with hair-pencil, fovea well developed, forewing with SC $^{1\,2}$ coincident, free, DC^2 inbent before origin of R^2. Second and third tergites of abdomen with distinct paired blackish spots. *Forewing* appreciably narrower than in *monticolaria*, with termen more bent in middle, nearly (but not quite) as extreme in shape as in *avitusaria*, Walk ; rather darker than in *monticolaria*, rather sharply marked, the antemedian and median lines rather more oblique, the shadowy line which represents the postmedian of the underside better developed, not meeting the exangled postmedian until close to hindmargin, the angle of this latter postmedian less blackened, the duplicating line outside it less complete, more macular. *Hindwing* also suggesting the shape of that of *avitusaria* ♂, only with the teeth slightly less extreme. Underside with the dark borders heavier, more smoky, recalling very dark-bordered *avitusaria*, but with the pale terminal patches of forewing largely obliterated, even that at apex small.

Laukhaung, July 1923, the type only.

A ♂ from Ding Manon, West China, stands with *monticolaria* in Coll. British Mus. ; one each from the Khasis and the Nagas, rather large and bright, are unnamed in Coll. Tring Mus.

* 209. *Semiothisa subalbataria* (Swinh.)

Gubaria subalbataria, Swinh, *Proc. Zool. Soc. Lond*, p. 428 (1889) (Nilgiris).

Laukhaung, April–May 1923, 2♂♂.

One is a dusky aberration, with the subapical dot of forewing wanting on the underside, etc.

The species is widely distributed in India.

* 210. *Semiothisa myandaria* (Walk.) (?)

Macaria myandaria, Walk, *List Lep. Ins.*, xxvi. 1649 (Canara).

Htawgaw, September–October 1923, 1 ♂.

This troublesome group has already been the subject of some investigations, but they are not yet completed. Walker's type has lost its antennæ, but the genitalia, kindly compared by Mr. W. H. T. Tans with those of Hampson's type of *Gonodela triangulata* (*Ill. Het.*, viii. 112), prove that the union proposed in *Faun. Ind. Moths* iii. 205 is quite incorrect. A fairly common Khasi species, however, with non-serrate ♂ antenna, shows but a minor difference in the genitalia, which may prove racial only, from those of Walker's type, and it is to this Khasi '*myandaria*' that the Htawgaw specimen seems to belong, though it is an extremely dark aberration or local form.

* 211. *Orsonoba æthocrypta*, sp. n. (Pl. ii, Fig. 14)

♂, 40 mm. Face, palpus, antennal shaft and one side of femora red, spotted with yellow. Vertex, thorax and abdomen concolorous with wings, the pectus mixed with red.

Forewing with terminal tooth strong, tornal lobe pronounced ; S.C.$^{1\cdot 2}$ stalked ; olive-green, clouded with olive-brown and with pale lilacine shades at base, at tornus, proximal to the antemedian line and as a linear distal edging to the postmedian ; a paler, yellow-green patch in median area between cell-spot and hindmargin ; markings much as in *O. clelia* Cram. or *O. variaria* Leech (*Seitz Macrolep.*, iv. 326, Pl. 16 *b*, as *Phalæna*) ; a white sub-terminal dot in front of R′. *Hindwing* with the teeth in termen pronounced ; postmedian line not crenulate, subterminal feebly indicated.

Underside predominantly red irrorated with yellow ; forewing with costal margin partly buff, dark-dotted ; ill-developed lilacine shades in distal part of cell, between postmedian and subterminal (except between the radials) and at tornus ; cell spot large, black, the pale band behind it white and buff (continued as an amorphous costal mark on hindwing) ; sub-terminal line black. Hindwing with similarly placed lilacine shades, the outer one not interrupted at radials ; cell-spot small.

Hpimaw Fort, August 9–13, 1923, the type only.

A few other examples have been detected or received since the above description was prepared, showing that the species occurs at Masuri, Sabathu and Solun and in Sikkim (Gopaldhara) and is—like most of the withered leaf species—variable in colouring, the underside rarely so bright as in the type. It may perhaps prove a form of *variaria* Leech ; Leech's unique type has the tornal lobe of forewing folded under, hence overlooked by the artist for Seitz.

212. *Petelia vexillaria* (Guen.)

Pachydia vexillaria, Guen., *Spec. Gén. Lép.* x. 138 (1858) (Borneo).

Wansong, 11 miles East of Myitkyina Plains, January 10, 1923, 1 ♂.

An extremely purple-grey clouded aberration.

This species, No. 3275 in Hampson's *Faun. Ind. Moths* iii. 217, is very widely distributed in the Indian and Malayan Subregions. If there are separable races the name of *capitata* Walk. can be utilized for the Indian. Earlier misidentifications were corrected by Swinhoe (*Tr. Ent. Soc. Loud.* 1902, p. 611) and finally laid to rest by Oberthur's figuring the type specimen (*Et. Lép.* xx., Pl. dlvii. Fig. 4778).

213. *Syrrhodia lutea* (Stoll)

Phalæna Geometra lutea Stoll in *Cram.*, *Uitl. Kap.* iv. 157 and 250, t. ccclxx. Fig. C, D. (1781) (Java).

Myitkyina, January 6, 1923, 1 ♂.

Belongs to the pinkish aberration (nearly *ennomaria* Guen). The species is distributed through North India, Malaya, etc., and has close relatives in the greater part of the Indo-Australian Religion.

214. *Anthyperythra hermearia* Swinh.

Anthyperythra hermearia Swinh., *Tr. Ent., Soc. Lond.* p. 485, Pl. xix, Fig. 9 (1891) (Khasis).

Htawgaw, April 4–10, 1923, 1 ♂ ; Hpimaw Fort, August 9, 1923, 1 ♀.

Both have the blotch of the forewing broad ; the ♀ is otherwise quite normal, the ♂ small and rather aberrant.

* 215. *Aspitates trilinearia* (Leech)

Loxaspilates (?) *trilinearia*, Leech, *Ann. Mag. Nat. Hist.* (6) xix. 235 (1897) (Wa-Shan).

Htawgaw, April–May 1923, 1 ♀.

Only Leech's type of this very distinct species hitherto known, likewise a ♀.

* 216. *Psyra spurcataria* (Walk.)

Hyperythra spurcataria, Walk., *List Lep. Ins.*, xxvi. 1498 (1862) (Darjiling).

Hpimaw Fort, June 1923, 1♂.

The specimen belongs to the dark form. The species is known from the North-West Himalayas Sikkim, Assam and Siam.

217. *Fascellina chromataria* Walk.

Fascellina chromataria, Walk., *List Lep. Ins.*, xx. 215 (1860) (Ceylon).

Hpimaw Fort, August 14–18, 1923, 1♂.

Common and widely distributed, though probably some of the localities enumerated by Hampson (*Faun. Ind. Moths*, iii. 225) may produce local races or representative species.

* 218. *Fascellina plagiata* (Walk.)

Geometra plagiata, Walk, *List Lep. Ins.*, xxxv. 1601 (1866) (Sikkim).
Htawgaw, April 4–10, 1923, 1♂, July 1923, 2 ♂♂; Laukhaung, March 9, 1923, 1 ♂.

The Laukhaung specimen is a small ab., with the underside of the hindwing green instead of yellow.

This is another rather common species, from North India to the Malay Peninsula and Java.

* 219. *Fascellina inornata*, Warr.

Fascellina inornata, Warr., *Proc. Zool. Soc. Lond.*, p. 399 (1893) (Sikkim).
Htawgaw, July 1923, 1 ♂.

Hampson (*Faun. Ind. Moths*, iii. 225–8) has sectionized this genus by shape, a scheme which would have been very serviceable had he not stultified himself by one or two errors of observation. The present species has an excision (though small) at the tornus of the forewing and should therefore be in Sect. II, not Sect. IV, and *fuscoviridis*, Warr. (*Nov. Zool.*, iii. 320, Khasis), which Hampson (*Journ., Bombay Nat. Hist. Soc.*, xi. 718) has numbered '3298 *a*', thereby placing it in Sect. I, has exactly the same shape, being in fact, as I believe, nothing more than a colour-form of *inornata*.

220. *Leptomiza calcearia* (Walk.)

Hyperythra calcearia, Walk., xx. 132 (1860) (*sine loc.*)
Hkamkawn, February 8, 1923, 1♀; Laukhaung, March 10, 1923, 1♂.

221. *Ocoelophora lentiginosaria* (Leech)

Collix lentiginosaria, Leech, *Ent. Supp.*, p. 55 (1891) (Japan).
Hpimaw Fort, September 18, 1922, 1♀; Htawgaw, July 1923, 1♂.

The Hpimaw specimen is very dark, too worn to say much about, but apparently conspecific with the Htawgaw ♂, which is a small example of the widely distributed *lentiginosaria*. The Khasi form, which I erroneously called *maculifera* (*Seitz Macrolep.*, iv. 328) is perhaps racially separable, in which case the Burmese examples would go with it. More material is wanted.

* 222. *Ocoelophora agana*, sp. n. (Pl. ii, Fig. 16).

♂, 31 mm. Head and body concolorous with wings. Face mixed with black. *Forewing* with termen smooth; Sc^1 free; pale grey, only at base of costa slightly more rufescent (extreme costal edge here blackened); sparse dark irroration, least sparse in proximal area; antemedian line consisting of large blackish dots on veins and folds, only weakly outbent in cell; cell-dot obsolete; median line only developed from M^2 to hindmargin, thickened posteriorly, angled outward on SM^2; postmedian consisting of costal mark and vein-dots, minutest on R^2, R^3 and M^1; radial and posterior spots beyond about as in the allies; terminal spots very weak, only discernible anteriorly. *Hindwing* very feebly (scarcely) crenulate; a small cell-dot; median shade represented by patches of irroration at both margins; postmedian vein-dots large on C and SC^2, then small and weak, slightly connected by a line posteriorly.

Underside similarly marked; the rufous anterior flush of forewing (common in the genus) rather extensive but not intensive.

Hpimaw Fort, early July 1923, the type only.

Distinguishable by its smooth termen, weak markings and more than usually distal position of median shade.

* 223. *Gonodontis bilinearia* (Swinh.)

Crocallis bilinearia Swinh., *Proc. Zool. Soc. Lond.*, p. 423 (1889) (Kulu).
Kangfang, September–October 1923, 1 ♂.

The specimen is coarsely irrorated, agreeing with a ♂ from Jalauri Pass and (except in its less bright ochreous colour) with a ♂ from Kujiar and a ♀ Goorais Valley, all in Coll. Brit. Mus. The species, which is otherwise known to me from Sikkim and the Nagas, is moderately variable and possibly embraces a mixture.

* 224. *Gonodontis acutaria* (Leech)

Crocallis acutaria Leech, *Ann. Mag. Nat. Hist.* (6) xix. 221 (1897) (Chang Yang).

Hpimaw Fort, August 9, 1923, 1 ♂, August 14–18, 1923, 1 ♂.

May prove to intergrade with *heydena*, Swinh. (*Tr. Ent. Soc. Lond.*, 1894, p. 203), from the Khasis. I have differentiated another race (?) from the North-West Himalayas as *contaminata* (*Seitz Macrolep.* iv. 331, Pl. 16*g*).

* 225. *Gonodontis insulata* (Bastelb.)

Odontopera insulata, Bastelb., *Ent. Zeit.* (*Stuttg.*) xxii. 77 (1909) (Formosa).

Gonodontis variegata, Wileman, *The Entom.* xliii. 348 (1910) (Formosa).

Htawgaw, September 16, 1922, 1 ♂.

A variable species. I believe—but do not yet feel entirely confident—that a dark ♂ from Chungking (Szechuan) is conspecific with it and I associate with this latter the Htawgaw specimen, which is a pretty ab., of a light violet-grey tone, with the median area rather narrowly but brightly ochreous. The excision is the termen of the forewing appears slightly less deep than in the typical Formosan examples.

* 226. *Garæus specularis* Moore

Garæus specularis, Moore, *Proc. Zool. Soc. Lond.*, p. 623, Pl. xxxii, Fig. 3 (1867) (Sikkim.)

Htawgaw, September 16, 1922, 1 ♀.

* 227. *Garæus cruentatus* Butl.

Garæus cruentatus, Butl., *Ann. Mag. Nat. Hist.* (5) vi. 224 (1810) (Sikkim).

Htawgaw, July 1923, 1 ♂.

* 228. *Garæus apicata* (Moore)

Auzea apicata, Moore, *Proc. Zool. Soc. Lond.*, p. 617 (1867) (Sikkim).

Htawgaw, July 1923, 4 ♂♂ ; Hpimaw Fort, August 9, 1923, 1 ♂.

Range : North-West India to Burma. I have described (*Arch. Nat.*, 77A, 10, p. 290) a race from Formosa.

* 229. *Pseudomiza argentilinea eugraphes* Prout

Pseudomiza argentilinea eugraphes, Prout, *Ann. Mag. Nat. Hist.* (9) xi, 320 (1923) (Htawgaw).

Htawgaw, August 22, 1922, the type ♂ only.

* 230. *Pseudomiza cruentaria* (Moore)

Cimicodes cruentaria, Moore, *Proc. Zool. Soc. Lond.*, p. 616 (1867) (Bengal).

Htawgaw, early July 1923, 2 ♂♂, 1 ♀, September–October 1923, 1 ♀.

The late specimen belongs to the form *flavescens* Swinh. (*Ann. Mag. Nat. Hist.* (7) xvii, 284) = *serinaria* Th.—Mieg (*Misc. Ent.* xxii, 43), (syn. n.).

On the range and variation I have a brief note in Seitz's *Macrolepidoptera*, vol. iv, p. 328.

* 231. *Pseudomiza castanearia* (Moore)

Cimicodes castanearia, Moore, *Proc. Zool. Soc. Lond.*, p. 616, Pl. xxxii, Fig. 1 (1809) (Sikkim).

Htawgaw, October 14, 1923, 1 ♂.

* 232. *Polyscia ochrilinea* (Warr.)

Polyscia ochrilinea, Warr., *Nov. Zool.* iii, 148 (1896) (Khasis).

Laukhaung, March 6, 1923, 1 ♂.

* 233. *Auaxa kaluga* Swinh.

Anaxa [ex. err.] *kaluga* Swinh., *Ann. Mag. Nat. Hist.* (7) vi. 308 (1900) (Jaintia Hills).

Hpimaw Fort, June 1923, 1 ♀.

The specimen is heavily marked, like *cesadaria*, Walk. (*List Lep. Ins.*, xx, 271), of which *kaluga* may be a race, the chief difference being in the postmedian line ; *cesadaria* extends from Japan to West China, *kaluga* is known from the Khasis and I have one ♀—also slightly transitional towards *cesadaria*—from Vrianatong, Tibet.

* 234. *Gnophos cinerea* (Butl.)

Pseudasthena cinerea, Butl., *Ill. Het.* vii. 108, Pl. cxxxvi, Fig. 13 (1889) (Dharmsala).

Htawgaw, August-September 1923, 1 ♂ ; Hpimaw Fort, June 1923, 1 ♀.

A fairly common mountain species, Kumaon, Sikkim, Assam ; in West China represented by *lilliputata*, Pouj. (*Ann. Soc. Ent. Fr.*, 1895, p. 308, Pl. vi. Fig. 7, 7*a*).

* 235. *Gnophos approximaria* Leech

Gnophos approximaria, Leech, *Ann. Mag. Nat. Hist.* (6), xix. 327 (1897) (W. China).

Fenshuiling Pass (4 miles from), early July 1923, 1 ♀.

* 236. *Ctenognophos methoria*, sp. n. (Pl. II, Fig. 12)

♂, 62-64 mm. Head blackish brown ; vertex with some pale admixture. Antenna pectinate to slightly nearer the apex than in the allies (66 or 67 pectinations, reckoning to the last definitely projecting tooth), the branches light reddish brown. Thorax and abdomen concolorous with wings. Hindtibia not dilated. Wings shaped as in *ventraria* Guen. (*Spec. Gen. Lèp.* ix. 294).

Forewing with SC^1 shortly stalked with SC^2, anastomosing with C ; deep plumbeous grey (in the darker ab. almost black), with a rather ill-defined pale, brown-mixed area corresponding almost exactly to the slightly more ochreous area of *ventraria*, but a little ampler in its triangular costal part ; this area, as in *ventraria*, marked with small dark strigulæ (which in the middle part tend to break up into dots) and with some slight brown shading on the veins, at the edge of the median shade and towards the apex ; cell-mark elongate ; lines crenulate, black, both about as in *eolaria*, Guen. (*Spec. Gên. Lêp.* ix. 294), but not arising from costal spots, the postmedian slightly more distally placed ; subterminal pale line obsolescent, broken into spots ; terminal dark line scarcely differentiated ; fringe dark, with a faintly paler line at base. *Hindwing* almost entirely clouded with dark plumbeous grey ; cell-dot indicated ; a slight cloudy median shade beyond postmedian line as in *eolaria*, but slightly more distally placed ; subterminal and terminal as on forewing.

Underside grey, with some dark irroration ; both wings with black cell-mark (on forewing elongate) and postmedian vein-dots, scarcely connected by a fine and faint line ; an ill-defined dark smoky distal band, darkest proximally to the subterminal, well separated from the postmedian, on forewing leaving free a small quadrate apical patch, on hindwing weak and narrow, subterminal, almost obsolete in posterior half.

Hpimaw Fort, September 18, 1922 (type), September 24, 1922 (paratype).

An interesting link between *ventraria* and *eolaria*, though larger than either.

* 237. *Enantiodes consanguinea*, sp. n. (Pl. ii, Fig. 10.)

♂, 36 mm. Close to the genotype, *stellifera*, Warr. (*Nov. Zool.* iii. 133) possibly a remarkable aberration of it.

Slightly broader winged, median line of forewing and postmedian of both wings more distally placed, the postmedian slightly less sinuate, the white subterminal spot of forewing obsolescent.

Fenshuiling Pass, early July 1923, the type only.

238. *Ectropis conjunctaria* (Leech) (?).

Boarmia conjunctaria, Leech, *Ann. Mag. Nat. Hist.* (6). xix. 344 (1897) (Ta-chien-lu.)

Htawgaw, early July 1923, 1 ♀.

Provisionally regarded as a small dark form of this species, or at least of the ♀ which Leech, not quite convincingly, mates therewith. Cloudy dark borders beneath—especially on forewing—more strongly developed than in Leech's ♀.

239. *Ectropis nigrosparsa,* Wileman and South (form ?)

Ectropis nigrosparsa Wileman and South, *the Entom.* 1, 54 (1917) (Formosa).
Hpimaw Fort, June 1923, 1 ♀.

Another provisional determination, the specimen being rubbed, the ♂ wanting. In any case not closely like the Formosan type.

240. *Ectropis* sp. (?)

Hparĕ, 1 ♀, September 1923.

I at first thought this specimen, also rubbed, might possibly represent a second-brood form of the preceding, but the palpus seems shorter and darker and $SC^{1 \cdot 2}$ of the forewing are short-stalked, not—as in that—separate.

* 241. *Ectropis cyclophora* (Hmpsn.)

Boarmia cyclophora, Hmpsn., *Journ., Bombay Nat. Hist. Soc.*, xiv. 504 (1902) (Sikkim).
Hpimaw Fort, August, 9–13, 1923, 1 ♂.

So far as I am aware this is only the second known specimen of the species.

* 242. *Ectropis chrysoteucta,* sp. n. (Pl. 77, Fig. 22).

♀, 36 mm. Head buff, mixed with bright golden yellow. Palpus rather short, predominantly blackish fuscous. Antenna minutely pubescent; buff, dark-spotted. Thorax above predominantly golden yellow; abdomen above varied with whitish buff, golden yellow and dark fuscous. Foretibia, foretarsus and midtarsus darkened, with pale spots at ends of joints; hindtarsus more slightly darkened.

Forewing broad, termen curved, anteriorly scarcely oblique; $SC^{1 \cdot 2}$ coincident, stalked with SC^{3-5}; bright golden yellow, with black irroration; markings black; cell-spot slightly elongate; antemedian bent outward at both folds, inward at SM^2; median well beyond cell-spot, distinct at costa, then rather deeply dentate but almost obsolete, rather near the postmedian; postmedian spotted on veins, subobsolete between; a dentate subterminal indicated by a sprinkling of whitish scales and by some black irroration, especially proximally; this irroration develops into a spot at R^3–M^1 and smaller and weaker ones at costa and behind M^2; termen with black interneural spots; fringe weakly spotted opposite the veins. *Hindwing* ample; termen scarcely crenulate except in middle, a slight curve inward between the radials; concolorous with forewing; cell-spot rather larger; median line just proximal to it, straightish to fold, then rather more oblique outward; postmedian slightly incurved between R^3 and M^2; subterminal appearing double—or broadened and with some black spots in its middle.

Underside glossy greyish, with a slight fleshy tinge; cell-spots strong; median line present on both wings, that of forewing only just beyond cell-spot; postmedian of both wings marked by dots on the veins; distal area broadly, but not solidly, suffused with dark smoke-grey.

Htawgaw, April–May 1923, the type only.

(*To be continued.*)

REVIEWS

GOLD FISH CULTURE FOR AMATEURS by A. E. Hodge, F. Z. S. and Arthur Durham.

This book illustrated with photographs and text figures, solves the question in a practical way as to whether Gold Fish can be bred in an aquarium. It begins with the history of the Gold Fish, and then gives a description of the various varieties with illustrations to enable the novice to distinguish one from the other. It deals fully with the setting up of a stock tank, with sexing and pairing, and rearing of the fry. Various methods by which culture of natural food, e.g. Bloodworms and *Daphinœ*, can be obtained are given in the Chapter on ' Foods and Feeding.' A brief description is given of the diseases to which Gold Fish are commonly subject, and of their treatment so as to enable the novice to diagnose and cure the ailments of his own stock.

To the amateur the book is specially recommended, to the expert fancier it will be an addition to his knowledge, and to one who has no pastime, it may teach how to spend some of his leisure hours.

The book is published by H. F. and G. Witherby ; 326, High Holborn, London, W. C. 1 and is priced 5*s*.

HAMID KHAN, M. Sc.,
Superintendent of Fisheries,
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BIG GAME HUNTING IN THE HIMALAYAS AND TIBET by Major Gerald Burrard, D. S. O., R. F. A. With illustrations and maps. (Herbert Jenkins, London.)

Major Burrard has given us a very interesting book, and one which contains much advice of value to the big game hunter.

It is a pity however, that he has included a chapter on the tiger and on some other animals from Burma, which can hardly be considered as coming under the heading of either the Himalayas or Tibet. Again the chapter on the leopard is almost entirely written with reference to the plains of India ; no mention being made of the most sporting method of shooting them, namely tracking them up in snow, and which can only be carried out in the hills.

It is also to be regretted that the author has not dealt with the various species of animals in some sort of systematic order.

The maps showing the distribution of some of the animals are useful, but the author should have checked his information when fixing the boundaries of Burhel and *Ovis ammon hodgsoni ;* Burhel extend W. of the Zanskar River and 70 miles W. of Leh in both the Indus and Shyok Valleys. The reviewer has shot them in all three places. It is also hard to understand why that very interesting river the Chenab has been omitted in this map.

Ovis ammon are found considerably further W. in the Indus and Zanskar River catchment areas than the author is evidently aware of.

It is evident that Major Burrard has but a slight acquaintance with Kashmir, and though his advice to beginners as to seeking new ground is excellent, he is evidently not aware that much of the country he recommends is now very difficult of access, owing to recent legislation having caused transport to become almost unobtainable.

The hints on care of rifles are excellent.

The photographs illustrating the book are of high quality, but would have been improved by the introduction of some more photos of big game, or their substitution for some of those of scenery.

C. H. S.

THE JOURNAL OF THE DARJEELING NATURAL HISTORY SOCIETY, VOLUME I No. 1, (Issued June 1926), Edited by C. M. Inglis F.Z.S., F.E.S., M.B.O.U.

The Darjeeling Natural History Society, which was started about the end of 1923, with the object of maintaining the Museum in proper condition, promoting the study of Natural History, and for the purpose of getting together as complete as possible collections of Natural History specimens from a limited area including the civil districts of Jalpaiguri and Darjeeling and the State of Sikkim as well as what could be procured from the neighbouring countries of Tibet, Bhutan and Nepal, has just published the first number of its Journal, which forms a very welcome addition to our literature, and Mr. C. M. Inglis as editor, is proof enough of its soundness.

The editor starts a series of articles on the Game Birds of Sikkim with the Bengal Green Pigeon (*Crocopus phœnicopterus phœnicopterus*). He notes it is entirely a plain species and then quotes Stuart Baker who says it ascends the hills to 4,000 ft. in exceptional cases. In the Simla hills it is found, in one favoured spot at least, up to 3,500 ft. Probably the ripening fruits of the Pipul and Banyan trees attract it.

A portion of the Journal is devoted to the description of new sub-species of birds found within its 'sphere of influence' described in the Bulletin of the British Ornithologists' Club, and the notes on *Pnœpyga squamata*, Gould., the Scaly-bellied Wren, are specially interesting as they corroborate what we have long suspected to be the case.

A number of very interesting Miscellaneous Notes are followed by an Editorial which enumerates the contributions received by the Museum since December 15, 1925, including 159 specimens of small mammals presented by the Bombay Natural History Society from the collections made by our Mammal Survey within that area. These consist of 72 species of which 50 were not represented in the Museum before.

Though the beginning is a small one (the present number being one of only 14 pages, 8″ × 5″) the Journal has started on the right road by appealing to sportsmen and bird-lovers in general, as well as to the Scientific Naturalist, and we offer our best wishes for its success, both to the Society and to the Editor who is one of our oldest members and a member of our Managing Committee.

S.A.A.

THE PALMS OF BRITISH INDIA AND CEYLON by E. Blatter, S.J., Ph. D., F.L.S. i–xxviii+600 pp., 106 Plates, 2 Maps, 49 Figures in the text (Oxford University Press, 1926). Price Rs. 30.

We have been looking forward to the publication of this volume for a considerable time. The readers of our journal will remember that Father Blatter published a series of articles on the Palms of British India and Ceylon between the years 1910–1918. In the meantime the author has gathered new material, a number of inaccuracies have been corrected, and the general arrangement has been changed in various places.

Though the palms from such a prominent feature of the flora of British India, and in spite of the fact that a great number of foreign palms have been introduced from all parts of the world by curators of botanical gardens as well as by horticulturists and amateurs, we had so far no book that told us anything about the palms which are not indigenous to the Indian soil. The palms form a difficult group not only to the layman but even to the professional systematist. The difficulty is increased if we are confronted with palms of which nobody knows either the origion or name ; and even if you are lucky enough to discover a label in some botanical garden which tells you that the palm came originally from Australia or South America, there is absolutely no means for most people in India to obtain further information on the object in which they are interested.

Father Blatter's volume has done away with these difficulties. It contains practically everything that can be said on the palms at present growing in India and Ceylon, either wild or cultivated. The indigenous palms had received careful attention by botanists before, beginning with Griffith in 1850 down to the completion of Hooker's *Flora of British India* and the authoritative Monographs of Beccari and Mortalli on certain groups of palms. But the foreign palms were entirely neglected. We have to thank Father Blatter for having undertaken the laborious task of wading through such an amount of literature as is indicated in his extensive bibliography, in order to present us with a complete account of our palm-flora. Representatives of almost forty genera which are not Indian have been described. The mere descriptions, however, being of a strictly scientific character, would scarcely have appealed to the layman. The popular element has been supplied by over 100 excellent full-page plates and numerous figures in the text which will enable even the amateur to arrive at the correct identification of his nameless favourites.

Notes on gardening are numerous, and the economic side of palm-trees has been treated extensively. Those who are anxious to have still more information on certain points will find the up-to-date bibliography a reliable guide.

Even the 'human side' of the palm-tribe has not been overlooked. Many an interesting legend and story are told which go to show what part the palm has played in the life and history of the human race.

R. A. S.

A HANDBOOK OF THE BIRDS OF EASTERN CHINA by J. D. D. La Touche (Taylor and Francis, London). Part III. May 1926.

We are glad to record the appearance of Part III of Mr. La Touche's *Handbook to the Birds of Eastern China*, of which the publication of the first two parts has already been noticed in the Journal. The new part deals with the families Pericrocotidæ, Artamidæ Dicruridæ, Sylvidæ, Regulidæ, Oriolidæ, Eulabetidæ and Sturnidæ all of which are familiar to the student of Indian Ornithology. One new race *Cisticola exilis courtoisi* is described on p. 237 from S. Yunnan, and on p. 224 Mr. La Touche has separated and described a specimen of *Locustella certhiola* from Chinwangtao which on account of its wing formula he is unable to attribute to any named form; he has however as yet hesitated to name it. The account of all four races of *Locustella certhiola* is largely based on Dr. Sushkin's examination of this interesting group and should be consulted by any Indian student who tackles these difficult birds. No races have been recognized in the new edition of our Fauna.

Mr. La Touche not only recognizes *Acanthopneuste* as separable from *Phylloscopus*, but further diminishes the latter by the recognition of the genus *Oreopneuste*, which we consider rather unnecessary. Otherwise his treatment of the families enumerated above follows the recognized lines that we are accustomed to in the new edition of the Fauna.

As in previous parts there are two good plates of photographs to illustrate typical bits of country in Eastern China, and in addition there is a clear and well-printed sketch map of China and the neighbouring countries, extending as far west as Bhutan. Detail has rather been sacrificed to clearness, but we think with advantage; while the division between Palæarctic and Oriental Eastern China has been admirably indicated in colour.

In conclusion we may heartily congratulate Mr. La Touche on this further instalment of his book.

H. W.

EDITORIAL

GAME PRESERVATION

During the last two years we have received a large number of interesting letters on the subject of Preservation of Big Game in India.

The correspondence originated with a letter from a member of the Society living in Southern India, who gave a most depressing account of the state of affairs in the Nelliampathy Hills and suggested that the Society should take early steps to urge the Government to legislate with a view to saving the game from extermination.

On receiving this letter we wrote to a number of Forest Officials and experienced shikaries, asking for their opinions, both as to the state of the Big Game in various parts of India and the best method of preserving it. In nearly every case we received a lengthy and most interesting reply, while, though opinions varied in one particular, the general purport of the letters agreed to a very great extent.

The first point to emerge was that the present state of the big game is, taken all round, decidedly good, though in some localities there has been a serious depletion, amounting in one or two cases to almost complete disappearance.

It has also been evident from most of the letters received, that we must now expect a steady diminution of the game in most parts of India.

The adverse factor to the existence of game is almost without exception, man. Rinderpest in Peninsular India has accounted for large numbers of bison and buffalo, while foot and mouth disease killed many *Ovis ammon* in the higher hills.

Man affects the existence of game in two ways. First, as a settler clearing the forest and driving the game completely from its habitat by grazing cattle. In this case it is evident that the game must go, and it appears that it is this which is seriously affecting the existence of the game in parts of Assam, which was, up to quite recently, one of the best big game countries of the world. It appears, however, that this is not at present affecting the game to any great extent in other parts of India.

It is as a poacher that man is the great destroyer.

In considering how to deal with the problem of the native who kills game, the first thing to be considered is his reason for doing it, and three reasons immediately appear. These are first for profit, in order that he may sell the meat, hide and horns, and this would appear by far the most common one.

The second is, for the meat only, and this is not so common.

The third reason, is to protect his crops, and no one can possibly complain of an agriculturist in any part of the world protecting his property in such a way.

The increase in the number of gun licenses issued has had a most fatal influence on the existence of game in many districts. It is not that the licensees themselves have done the actual damage, but that they have a habit of lending or hiring out their weapons to others. In many cases it is the custom for dear old Indian gentlemen whose figure puts out of the question their personally taking an active part in hunting, to send out their retainers with a gun to kill game for them, regardless of season, sex or size; and there is no doubt that by stopping this abuse of a gun license granted as a personal privilege, much game would be saved. It is very often for the purpose of such household use that gun licenses are applied for.

Such action would not however affect the poacher who poaches for pecuniary profit, and from a large number of the letters received, it is evident that the buyer is the person to get at.

Take this extract from a letter referring to the Eastern Ghats. 'There is no doubt that there has been a lamentable decrease in head of game . . . there has been a great increase in the export of skins, principally bison, buffalo and sambhar. This I believe to be the principal reason for the decrease in game. Local dealers finance the village shikari providing him with guns and ammunition.'

This is an example of what undoubtedly occurs in other parts of India also.

Bison, sambhar and cheetal hides are openly bought and sold in many bazars, and there is nothing to prevent it.

The sale of trophies is also carried on in Bombay, Calcutta, Rawalpindi and many other big towns.

If the poacher is deprived of his market, the temptation to kill is largely removed, and it would appear that there could be no possible objection to a general law throughout India forbidding the sale of any portion of a big game animal hide, horns or meat, with an *adequate* penalty for breaking it. It is no use imposing a fine of Rs. 5 while a bison hide fetches Rs. 25 and a Sambhar hide Rs. 15.

Such a law in no way interferes with the right of a ryot to protect his crops.

It should however, still be possible for Forest Officers to continue the sale of shed horns. It is easy for them to see whether a horn has been shed naturally or not.

The formation of sanctuaries is the principal point on which the letters differ. Where recommended the suggestion is always qualified by the remark that they are expensive ; as, to be effective, they must be well guarded by unbribable Game Wardens, and this is put forward as an insuperable objection by several. The majority are of the opinion that existing Reserved Forests are sufficient sanctuaries in themselves, and the general consensus of opinion is that the license holder is of considerable assistance in Game preservation. In this connection it might be remembered what has happened on nullahs being closed in Kashmir for a long period as sanctuaries : they have almost invariably been found almost empty of Game on being re-opened, closing them having proved to benefit the poacher only. This is the almost inevitable fate of any sanctuary in India, unless unbribable game watchers are found at very high rates of pay. As there is no prospect of such paragons ever being discovered without the expenditure of money never likely to be available, the provision of sanctuaries may be relegated to the dim future.

There is again the effect of preservation on the Forest itself. Bison and Sambhar both do a great deal of damage to young teak and other valuable timber trees, and must be kept within bounds. A sanctuary to be effective must be big, and there are few places where the Forest Department can afford to setaside a large tract of forest as a sanctuary.

One correspondent draws attention to the balance being upset in another direction, and gives figures to support his contention that tigers have taken to man-eating much more of late years in the Northern Circars owing to the decrease in their natural food, namely deer, at the hands of poachers.

To summarize the impression gained from the letters read it appears that what is principally needed is a law forbidding the sale of any part of a big game animal (carnivora excepted) save by a Forest Officer in the public interest. An adequate penalty to be enforced.

Secondly that the use of a gun except by the license holder in person be strictly fobidden and penalties exacted.

It only remains for us to accord our most grateful thanks to all those who have answered our letters and for the care and trouble they have taken in doing so.

MR. B. C. ELLISON

We are pleased to welcome back to India Mr. B. C. Ellison, from November 1920 to August 1923, Curator of the Society's Museum. Mr. Ellison was Curator at a time of flux—when the old order was changing, giving place to the new. He had to plan the move of the Society's Collections from their old home in 6 Apollo Street to the Prince of Wales ' Museum. He had to plan for the change from a small private Museum open only to a few—and that few interested, educated and knowledgable—to a public Museum open to the many—those many having to be made interested, and this the more difficult because the many were uneducated and not knowledgable. The change has been a great one as all members who knew the old and have seen the new will testify. Much remains to be done and further on we refer to Mr. Ellison's successor's views as to what the ideal public Museum should be. As Mr. Ellison watches the progress of the Museum he will think with pride on the share he took in setting it on its present foundation.

Mr. Ellison may best be remembered for his work as Naturalist to His Royal Highness the Prince of Wales during H.R.H's shooting expeditions in India. He has placed on record—and well placed too—the shikar experiences of H.R.H. and party, and his book *His Royal Highness the Prince of Wales's Sport in India*, edited by Sir H. Perry Robinson, K.B.E., etc. with an introduction by the Earl of Cromer, G.C.I.E., etc., is well worth buying and reading. It should find a place in every Mess ante-room and Club Library.

Mr. Ellison left India in March 1923 because he seemed to be a chronic sufferer from Malaria. He never seemed to be able to throw it off in Bombay but he has returned to India cured, and we hope during his tenour of office as Game Warden in Bhopal State he will be immune from his old enemy. We look forward to much help and assistance from him, and his successor and erstwhile assistant will, we know, be glad to hear of his close proximity to Bombay.

MR. PRATER IN AMERICA

We said in our last editorial that on 1st June our Curator, Mr. S. H. Prater, left Bombay on deputation to America to study the latest methods in Museum management now in vogue in 'God's own domains.'

We have since had a number of very interesting letters from Prater in which he waxes eloquent over American Museums, Methods and Money, and in fact over America itself and nearly everything American.

Writing on the 26th July from the American Museum of Natural History, New York, which has his first 'objective', he says, 'I am at present engaged in helping to mount an Indian Elephant by the new process which is quite different from any of the methods adopted in England and yields infinitely better results. It is all intensely interesting and some of the features of this Museum are an absolute revelation to me in Museum methods. They have developed the "group" system to a fine art and some of these exhibits are a triumph of art and technique. I propose working at the American Museum till the end of August and while here will take in the Brooklyn Museum and the Children's Museum. I will also make a study of the educational programmes and hope to bring back information that will be of value to our work in Bombay. Sometime in September, I shall go to the Field Museum at Chicago and also visit the Museums at Milwaukee and Denver—which are smaller Provincial Museums, but which are nevertheless excellent as types of well conducted small Museums. These are my main plans. I shall leave New York for London on the 6th October, spend 3 or 4 weeks in London and then go to Berlin and travel south *via* Leipzig, Munich, Frankfurt and Vienna.'

He continues on 2nd August thus: 'The more I study the methods and policy of this Museum the more I realize how very much the Museums in America diverge from the old accepted standards of Museum exhibition. The whole idea behind the policy here is to reveal nature and the truths of nature in a way in which the average visitor can and will understand it—not as the Curator thinks he ought to understand it. The Curator by his training and study has, or ought to have, a deeper and wider conception of the subject, but to endeavour to foist this conception on the untrained mind of the visitor is beginning at the wrong end of the stick. He must be led up to it by stages, by an arousing of his interest, by revealing some little bit of nature to him in a manner that he is familiar with;—everybody has seen bull frogs in the monsoon—put up a frog pool—illustrate the various stages in the life history of the frog, then show this in surroundings which are easily recognizable. Then you have something which will catch the eye—which will teach your visitor that frogs go through a series of changes from the egg to the adult. In this same group, on the leaves overhanging the pool, you can put in a tree frog and you will show adaptation to particular needs by revealing just how the padded toes of the tree frog enable him to sit securely on his unsteady perch—combine this exhibit with a classified set showing various species of frogs, and in a small space you have been able to give your visitor a much clearer lesson than rows and rows of stuffed frogs on shelves would have done. You can develop this method indefinitely. A group with say *Lycodon aulicus*, the eggs and a few young ones, and say an adult scaling up a sheer straight surface, will reveal that snakes are born from eggs, that adults differ from young in colouration and that a reptile, though limbless, can climb—illustrate the last point by a diagram showing just how the ribs are attached to the ventral scales to help the reptile in climbing and you have your lesson. Above all it will be important to combine utility with art; in such a representation the artistic and the beautiful will always attract. Now in the arrangement of my Mammal Gallery I have made classification the leading motif in the arrangement—classification is of interest to the taxonomist but of little interest to the average visitor. I do not for a moment wish to belittle the importance of classification—it is the foundation of the science of Biology, but I believe now that in the arrangement of a Gallery for the public the classification of Mammals might be made subordinate to other features in the life of mammals—features that would make a greater appeal to the visitor and interest him a great deal more. I am now making plans for the arrangement of this Gallery and with your approval and help I hope to be able to carry them through and to make that gallery something really beautiful and something that our Society will be proud of. I am sure that I shall be able to put up some really beautiful groups at a comparatively small cost. I am going very closely into the technique and the details of group making. I have learnt the art of giving sunset and dawn and moonlight effects—very beautiful in a group—these are quite simple after one has learnt how to do it.'

Again in his letter of the 19th August he says, 'What has impressed me most in this Institution is its ideal of "service" to the people; it is seeking every channel of activity whereby its utility might be increased; working with all the ingenuity, skill and resource at its disposal for their betterment. This Museum speaks to its visitors in terms they can understand, revealing nature in all its beauty and charm, showing them another world in which the ideals which seem so much to them are void of meaning and consequence. This interests them, awakens them, educates them. It is a method that Museums in other countries might well adopt—getting away from artificiality and ugliness—striving after beauty—beauty in the design of a gallery—beauty in the harmonious grouping of its cases, replacing drabness with colour and life, aiming not only at the pictorial in the treatment of an individual exhibit but also the aesthetic in the composition of a whole group of exhibits. This much I have learnt, namely that the purpose of a Museum is to encourage the observant powers, and its success is measured by its power of arousing new thoughts in the mind of the visitor and the greater number it can reach the greater its success.

It is not only by its exhibits that this Museum serves its public but by its very comprehensive and far-reaching educational service. I have been going into the details of this work with Dr. Fisher, the head of the Department of Education in the Museum. This service not only aims at making good naturalists but also at making good citizens. We in Bombay can do a great deal in this way—the Museum should be a centre for the diffusion of knowledge affecting every phase of the citizens' life. We have a Municipality; it has a health department and a water department. What just these departments are doing they can tell us and we can tell the people, by means of illustrated lectures, how the drinking water supply of the city is maintained; the importance of purity, health, and sanitation, how this is achieved and what is being done to achieve it. As regards the work of the Parel Laboratory, of the Improvement Trust, of the Agricultural Department, of the Forest Department, of the great Industrial Concerns, the heads of these should be asked to co-operate by providing material for lectures. The field is infinite—there is History and Geography and a thousand other things to tell people about and which they would be interested to know. The Museum should have a distinct department of education which should organize this work. It is something for the Trustees to think about and consider. I will endeavour to draw up concise reports of the various phases of Museum work for the Committee on my return.'

From his previous visit to some of the Museums in Great Britain, Prater has demonstrated to us that he is capable not only of absorbing new ideas but also of developing and putting them into use in a practical and efficient manner and we are looking forward to his return and to the revolution that will result in consequence in the Natural History Section of the Prince of Wales' Museum.

It is however gratifying to note that Prater realizes fully that the limits to our supply of the 'vernacular dollar' are so clearly demarcated, but we think he can be depended upon to take the fullest advantage of the Liliputian resources we shall be able to place at his disposal.

We are in full accord with the ideals of the American Museum, namely, that a Museum—and especially a Natural History Museum—should play a much larger part in the education of the youth of a city. A beginning in this direction is being made by us sometime early next month when a number of local schools will send classes of children for instruction in Nature Study, to our Section of the Museum. The beginning will be a small one but it is hoped that in course of time and with the help of Prater's advice and suggestions we shall be able to develop this into a really useful department of education and run it more or less on the lines found to yield the best results in America and Europe.

SHIKAR STORIES

We have recently received through Lt.-Col. R.L. Kennion, some pages from the ' Shooting Times ' containing, in an article entitled ' Through the Indian Jungle by Motor ', by Mr G. H. Knowles, a remarkable account of a tiger imitating the bellowing challenge of a bull (in this case one of the half wild cattle of northern Oudh) and so calling up a fine bull and killing it. It is further recounted how the tiger, to render the deception more complete, threw up dust with its feet, to imitate the pawing of the ground by a bull.

It is related that this incident was witnessed by the writer and three other Englishmen, who, between them, killed the tiger.

Col. Kennion wrote to the ' Shooting Times ' to enquire whether the story (which was written in rather florid style), was intended to be a strictly accurate account of the event related, but the author's reply, published in the same number of the paper as Col. Kennion's letter, is evasive and unsatisfactory.

We have submitted the story to two very experienced big game hunters, one of whom knows northern Oudh extremely well, and they agree that such an occurrence as is described is quite outside their knowledge and experience of the animals concerned.

Mr. Knowles, in his original story, cites the ' Sambhar ' call of the tiger as being used to call up sambhar to be killed. It is generally agreed however, that this call of the tiger is certainly not made for this purpose, and that there is no evidence to support this contention.

The statement added by Mr. Knowles that tiger also call up chital in the same way comes to our notice for the first time, and we should like to have further evidence as to the tiger imitating the ' bray ' of a chital stag, before accepting this as a zoological fact.

It is a pity that, in answer to Lt.-Col. Kennion's query, Mr. Knowles has not made a definite statement as to the exactness of his story, or referred to any of the other English witnesses to corroborate him.

Perhaps this may catch the eye of one of them, and, in that case, we hope he will let us have further information on the subject.

SIR SASSOON DAVID, BART., K.C.S.I.

It is with a feeling of deep regret that we have to record the death on 27th September of Sir Sassoon David, Bart. K.C.S.I.

Sir Sassoon's philanthropy and his open handed generosity in the cause of education is well known, and though not a member of this Society he was a true benefactor and took a keen interest in its welfare.

This was evinced recently by the munificent donation of Rs. 6,000 he made towards the first year's salary and expenses of the Guide Lecturer in Natural History appointed at the Prince of Wales' Museum.

Sir Sassoon was one of the original promulgators of the idea of having a Museum in Bombay worthy of her place amongst the foremost cities of the Empire and it is partly due to his efforts and enthusiasm that we find the Prince of Wales' Museum in existence to-day. It is to him also that we owe the beautiful statue in the Museum Grounds, of the King Emperor erected in commemoration of his visit to this city as Prince of Wales in 1905, when he laid the foundation-stone of the Museum.

MISCELLANEOUS NOTES

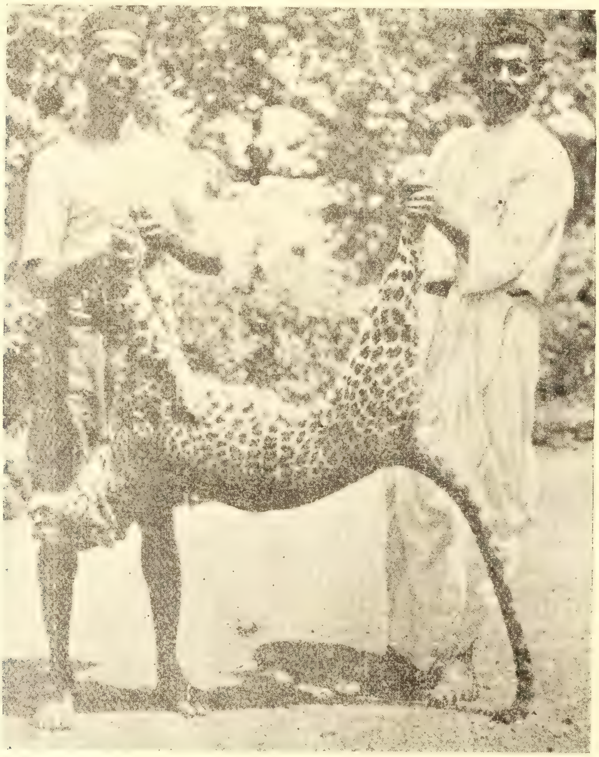
No. I.—A PANTHER SHOOT AT SEA

(*With a photo*)

The following rather curious case of a Panther being shot at sea may interest your readers.

In February last a small *Pattamar,* of about 60 tons, anchored off the Port of Mangalore and sent ashore two of the crew to report to the Port Officer, Mr. Sims, that they had that morning been attacked by a 'Tiger' on board. One man had been scragged down the face and breast, and the other had half his scalp removed.

As Mr. Sims asked me to accompany him out to the ship I witnessed what subsequently occurred. On arrival at the *Pattamar* we found she was five days out from a Port south of Bombay where she had loaded salt. They had not touched at any other port. That morning when a member of the crew had gone to the forepart of the ship (which is covered in for about 18 feet) for firewood, he was attacked by the 'Tiger'; a friend who went to his help also got scalped.



We found the *Pattamar,* with the balance of the crew of six men still aboard, was loaded from keel to gunwale with bags of salt. There was a space forward where they kept firewood and in which we were told was a tiger. They had been at sea with it for five days and never knew it was there till that morning.

After some time we managed to get the panther to move, it crawled into the light and suddenly raised its head between two pieces of timber. Mr. Sims then shot it in the head, between ear and eye, with a .320 revolver.

It proved to be a full grown male panther, measuring between pegs 5 feet 9 inches.

In Canarese these panthers are called 'Ni Kurukers,' living chiefly on dogs and small game.

At the port where the salt was loaded the boats go up a creek and tie up along side. The panther presumably got on board just before they put off, and crawled into the first available lair, which was on top of the stock of firewood. As the stock got reduced, the man who went for it daily at length came within striking distance of the panther and was caught.

The two wounded men were in hospital for over a fortnight, but eventually pulled round.

Mangalore, N. KIRWAN.
August 4, 1926.

[It would be interesting to learn what this panther was after, and what induced it literally to embark upon such a novel undertaking! An instance is related by Sir Samuel Baker of a tiger, during an inundation of the Brahmaputra, having climbed up in the night on the high rudder of a vessel much to the discomfiture of the native steersman when he beheld the visitor in the morning. In the uproar and confusion that followed the startling discovery, the tiger leaped from the rudder on to the barge which was lashed to the steamer, and having knocked over two men in its panic-stricken onset, bounded off the flat and sought security upon the deck of the steamer alongside, where he was eventually shot in the paddle-box. Eds.]

No. II.—THE BREEDING HABITS OF THE PANTHER (*FELIS PARDUS*)

Could you kindly inform me whether it is customary in felines for the males and females to remain in company after the latter become pregnant, and if so, for how long? I am sending you under separate parcel a bottle containing three cubs taken from the mother's womb, a couple of days ago, and would like very much to know how long she could have carried them.

This panther, together with a male, had been 'carrying on' for at least three days, on a hillside not half a mile from my house. I received *khubbar* about 3 p.m. and went out at once, to find a crowd of people looking on from immediately below the cave; there were quite 15 men, women and children, to say nothing of cattle grazing within 100 yards.

I was assured that the beasts had been chasing each other and playing a sort of hide and seek, from one cave to another, the whole morning, and making an appalling noise, and nobody had come to me as they heard I was in camp.

I climbed up to a point just opposite the cave, and within 15 minutes saw one beast bound from an upper to a lower cave, and a few seconds later the second one came up from some rocks below, and lay flat in front of the cave where the other had gone, and uttered a deep gurgle. I fired and she rolled down without a sound and lay in the nallah. I waited for an hour but the male did not put in an appearance, so I went home, had tea, and came back, leaving some men to talk and make a noise while I was away.

On my return they (the men) disappeared and all was quiet, and I saw the panther very stealthily come to the mouth of the cave and sit down, but all I could see was what looked like a handful of oak leaves.

Suddenly he looked straight at me and began slinking back, so, as the light was going, I took a snap at his head and missed. There was not a sound or sign of anything for about five minutes, when he suddenly showed up again, but this time with a bound and was gone, and a hurried snapshot again had no effect. I saw him no more, but three shepherds that were watching said he went off at a slow walk and appeared to be in no hurry.

I know that panthers are very daring at such times and are by no means difficult to approach, but to be watched by some 15 people at well under a 100 yards, with no jungle to speak of, is surely a bit of an achievement even among panthers, and is not the condition of the female and her share in the performance somewhat extraordinary?

Egerton Hall, Dharmsala Cantt, C. H. DONALD.
March 27, 1926.

[The three fœtuses received from Mr. Donald appear to be about a fortnight old. According to Dunbar Brander the male panther remains with the female throughout the gestation period until the cubs are born, but as to their actually 'carrying on' after insemination and for how long after, is an open question to which we would invite enlightenment from other sportsmen who may have had some experience on this point. It is certainly not usual for the female to mate until she is in a 'tumescent' state which occurs chiefly at the commencement of the breeding season only. Eds.]

No. III.—A TIGRESS WITH FIVE CUBS

On an evening in January, 1925, Lt.-Col. H. D. of Wellington and I were about to sit up over a tiger's kill when we received news that a tigress with cubs had killed a herdsman, near a village a mile off: the herdsman had apparently blundered into their lair, with fatal consequences. It was too late to do anything then; so we sent word that we would be on the scene of the tragedy early on the following morning. The tiger we were sitting up for came down the path, which ran between the kill and the machan roaring at about midnight. It took no notice of its kill but continued on its way, its roars sounding gradually fainter as it slouched on into the far distance. It did not return, unfortunately, and not a glimpse of it could we see as it passed our machan. We stuck to our machan till daylight hoping for its return but we hoped in vain. At 8 a.m. we were at the village and were taken to the lantana thicket where the herdsman had been killed. We soon found the poor fellow's blood-stained cloth and stick. The man had been able to reach the village before he died. We then heard one of the cubs calling plaintively, and one of our trackers spotted two of the cubs in thick lantana. The only means of getting into the cover, which can best be described as perfectly 'hellish,' was by cutting a path. The two trackers were detailed for this unpleasant job, while H. D. and I crept close behind them shoulder to shoulder, crouching. We very soon heard low and ominous growls from away inside the cover: and these growls got louder and more menacing as we cut our way further in, until finally it was evident that the tigress was on the point of charging. The two trackers were then placed on either side of and level with us and told to go on cutting. They had hardly started cutting again when the tigress charged with terrific coughing roars, but the cover was so dense that, although she came within a few feet of us, we only caught a momentary glimpse of her as she turned. We naturally expected her to charge but considered it unlikely that she would press her charges home, which proved correct. The tigress returned to her lair and commenced growling again. We advanced a little further into the cover with the same result. We were again charged, and again she turned when within a few feet of us, and we could see little or nothing of her. This nerve-racking game seemed likely to continue indefinitely as the tigress shifted her lair, retiring further into the lantana. Two men were behind us, and one of these I sent up a small tree to overlook the mass of lantana in the hopes of seeing an open patch anywhere to our front. Sure enough he spotted an open piece, free of lantana, and informed us that he could guide us to it from the other side, through lantana which was not so dense. We therefore retreated, and making a detour soon arrived at the place where our guide informed us we should enter the lantana in order to reach the open patch he had seen. The tigress however had evidently divined our intentions and we had not penetrated far into the lantana before we were met by another charge accompanied again by a series of coughing roars. The tigress retired again, and pushing forward a little further we found ourselves in a small open patch. The tigress could be heard growling behind a hedge of lantana to our front. Close to us was a small tree, on this Col. H. D. and I climbed in the hopes of being able to see the tigress, but with no success. I told one of our men however, to throw a stone in the direction of the muffled growls that proceeded from the wall of lantana in front of us without cessation. The effect was magical, as with a terrific roar the tigress charged out, a fine sight, all teeth and claw and a perfect mark. Desperately wounded by our shots (Col. H. D. fired first) the tigress however managed to turn round and gain the cover of the lantana before we could get in a second shot. We knew the tigress was badly wounded, but not necessarily crippled, and it was possible that we were in for a dangerous time following her up in the infernal lantana. We cautiously followed the blood tracks, after a wait of an hour, and came on four small cubs, which though hardly able to walk, snarled at us when we picked them up. We had not gone far before one of the Sholaga trackers with us whispered that he could see the tigress lying down. It took us a little time to discover that the thing the man was pointing at really was the tigress. It lay in thick lantana growling. Two more shots finshed her off, and a very fine tigress was the reward for our perseverance. While we were admiring her, a fifth cub, slightly larger than the rest came staggering along her mother's tracks, plaintively 'me-owing' in a deep and throaty way. Five cubs to a single tigress is I think unusual. Three unfortunately died, including the largest, although I procured a she-goat for each of the survivors. One was sent to the London Zoo, and the other to a Zoo in America. When rearing young cubs it should be remembered that in their natural state their mother encourages them to perform their daily 'duties' by licking their nether parts with her rough tongue while feeding them. In captivity therefore the use of a tooth-brush should be employed while they are having their morning feed.

ATTIKAN P.O., MYSORE, RANDOLPH C. MORRIS.
April 29, 1926.

[The usual number of young seen accompanying a tigress is two or sometimes three, though records of up to five or even six *being born* are not unknown. On p. 191, vol. v of this Journal, Capt. W. St. J. Richardson records taking five fully formed young ones from a tigress he shot. W. Forsyth (vol. xx, p. 1148) states that on 2 occasions he found 5 foetus in the uterus of a tigress, once within a week of being born, and J. B. Mercer Adam (vol. xx, p. 515) mentions a Karen in Burma taking five cubs found in the same lair and apparently from one mother.

It is therefore highly probable that a larger number of cubs is actually born than live to grow up, not the least cause of their failure to survive being the cannibalistic propensities of the parents.

It is a well known fact that tigers are partial to their offspring for dinner, and notes in support of this are continually appearing in the pages of this Journal. Among others, readers are referred to Col. Scott's note on 'Tigers eating their young' on page 253 of vol. vii and to another by the Honble. J. W. Best, on p. 1318 of vol. xxi. EDS.]

No. IV.—WILD DOGS AND FURTHER JUNGLE TRAGEDIES

Wild dogs are greatly on the increase in this portion of the Coimbatore District; and I believe the rewards for their destruction, given upto recently by Government, have been withdrawn.

During the last month packs of wild dogs have been killing Sambhur all over these hills and have, as well killed and devoured four heads of cattle that had been tied up in the jungle for tiger by sportsmen shooting in this block. I have never known this to occur before.

Far from withdrawing the rewards for the destruction of wild dogs, Government should take early steps to enhance the rewards previously given.

Jungle Tragedies.—(*a*) A solitary Bull Bison has recently been killed by a tiger in the jungle near here. There were signs of a great struggle having taken place. The head was brought in by Sholagas.

(*b*) A sambhur doe was killed, and torn literally limb from limb, by a rogue elephant a day or two ago. The sambhur was probably being chased by wild dogs and ran into the elephant: otherwise I do not see how this could have occurred.

Attikan p.o.,
April 28, 1926.

RANDOLPH C. MORRIS

No. V.—THE BREEDING SEASONS OF THE GOORAL (*NEMORHŒDUS GORAL*) AND HIMALAYAN TAHR (*HEMITRAGUS JEMLAICUS*)

I notice that Lydekker states that the young of Tahr are dropped in June and July and those of Gooral in May and June.

On April 20, 1926 in the Bheling valley, Tehri Garhwal at an elevation of 8,000 ft. I found a young gooral recently dropped, and on May 15, 1926 in the same place I saw a young tahr with a party of adults, so strong and well grown that it could not have been less than a month old.

Roorkee,
July 7, 1926.

E. E. G. L. SEARIGHT,
Capt. R. E.

No. VI.—JACKAL AND HARE

Apropos of a note by Mr. J. H. Amory on page 75 of the *Field* of January 14, 1926, entitled 'Fox and Rabbit' the following extraordinary behaviour of a Jackal witnessed by me on December 24, 1925 in the Cambay State might prove interesting.

We were out after partridge in the afternoon, and returning to camp had to walk over flat, open country interspersed with an occasional stunted shrub here and there.

It was just getting dusk when a pair of jackals were sighted crossing our path some distance ahead, and we decided to intercept them to see how close they would allow us to approach them. The leading jackal spotted us, and not being very satisfied regarding our bona-fides, started off at a slow trot immediately he perceived a change in our proceedings.

At this stage, I saw a hare jump out of a tiny bush about 50 yards from him, and taking a semicircular course at top speed, he made a bee-line in our direction. On seeing the hare, the jackal forgot all about us, changed his course and was instantly in hot pursuit. It was remarkable how speedily the hare was being overhauled by its pursuer although the latter appeared to be running at only an easy lumbering gallop. Unfortunately when the hare was within 20 yards of us, one of our party being unable to resist the temptation fired, luckily missing him. The hare only swerved in his course and kept going as before.

The jackal was now about 15 yards behind the hare, and therefore could not have been over 35 yards away from us. Notwithstanding, he appeared to pay no heed whatsoever either to our proximity and excitement or to the reports of the gun, but deliberately swerved off after the hare. I now let him have both barrels in quick succession of No. 8, and from the dust flying all round him have no doubt that a few shots at least did hit the animal, but even with this his attention was so riveted on his quarry that my firing did not seem to produce the slightest effect, for he stuck doggedly to his purpose.

Sixty yards further there was a dense thicket into which the hare promptly took cover. The jackal reached the thicket a moment too late, and still perfectly oblivious of our hasty approach, was eagerly sniffing and peering round it, when one of our party to get a better view of the proceedings commenced to run towards the spot. It was at this stage really that the jack took in the situation for the first time and, starting up at the intruders for an instant, made off full pelt with lowered tail. The other jackal had beaten a hasty retreat immediately the first shots were fired at the hare.

It was astonishing to observe this extreme recklessness created in a timid animal like the jackal when driven by hunger.

Bombay Natural History Society,
6 Apollo Street,
April 12, 1926.

SALIM A. ALI

No. VII.—HOW DO WILD DOGS KILL THEIR PREY?

On pages 32 and 33 of his excellent book, *Wild Animals in Central India,* Mr. Dunbar Brander, after discussing the methods usually employed by these animals in killing their prey, proceeds to say that 'the story to the effect that they are in the habit of emasculating the animals they attack can be discarded.' The disinguished author is presumably speaking of Central India, and it is therefore interesting to note that the same belief of wild dogs emasculating their prey holds also among the Jungle Karens of South Tenasserim. Some of these that I knew well, who had accompanied me on many a shooting trip, were trackers and hunters of life-long experience, with keen observation and a thorough knowledge of the ways and habits of the animals inhabiting their jungles. Their information on points that I could verify was in most cases surprisingly accurate, and after all there is a possibility that this widely-accepted belief may not be altogether without foundation. The following incident that I was fortunate enough to witness some time after I had heard this emasculation story from the Karens, has considerably enhanced my credulity.

In July 1922 I was out after Bison at Pyaungbok-choung on the outskirts of the Heinze Forest Reserve in the Tavoy District. The day had been a blank, the trudge infernal, and my spirits low to match. A peculiar yapping drew my attention, and turning in the direction of the sound, we soon came upon the carcase of a huge sambhar stag—horns shed—lying in the middle of a small choung. He was surrounded by an excited pack of wild dogs, some in the water, others on the carcase itself, yapping and tugging at the meat in ghoulish delight. One was caught in the rump with a solid bullet from my .423 Mauser, and a second, and yet another, missed. The marks on the ground and in the soft mud on the banks of the stream, plainly told the story of the tragedy. The Sambar probably dead beat, had rushed into the water to escape the demons at his flanks. His relentless foes had followed and pulled him down while in the act of clambering the opposite bank. The whole incident must have occurred within a few minutes of our arrival on the scene, as two of our party who had gone the same way half an hour previously, had noticed nothing. An examination of the Sambhar showed that all the meat from the face and skull had been completely devoured fully exposing the bone. The portion on which the dogs were busy when disturbed, was the part of the under surface, just behind the forelegs, where the girth of the saddle goes in a horse, and the abdomen was gradually being approached from this end. Strangely enough the only part touched in the hind quarters were the testicles which were clean missing. This, my Karens took in quite a matter of fact manner, and again maintained that it was the usual method adopted by the dogs when killing game. Probably some other sportsmen may be in a position to shed further light on the subject.

Bombay Natural History Society, SALIM A. ALI
July 14, 1926.

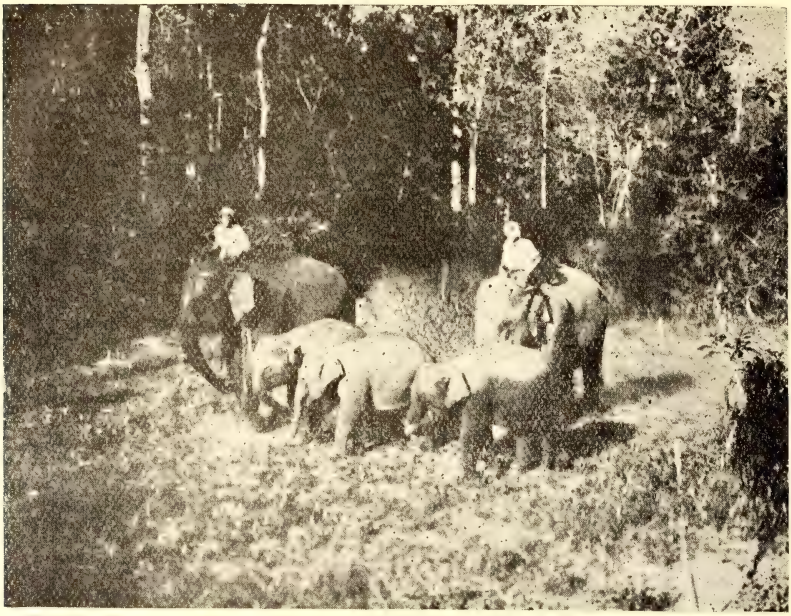
No. VIII.—TWIN ELEPHANT CALVES

(*With a photo*)

I enclose a photo taken by me in January 1924, of a cow elephant with twin calves born in captivity. These are the cow and two calves on the left of the photo. The twins were about three and a half years old at the time.

The other cow elephant is with her third calf born in captivity, her other two being 17 and 8 years old respectively, while the calf on the right of the photo is 4 years old.

All these elephants were the property of Messrs. Steel Bros. & Co., Ltd., and are on their timber-working establishment.



I was enabled to take the photo through the kindness of Mr. Gray, who is in charge of their timber operations on the Upper Thaungyin tributaries, where I took the photo.

AHMEDNAGAR,
March 15, 1926.

C. H. STOCKLEY,
Major.

[The birth of the identical twin calves was recorded by Mr. Gordon Hundley on page 629 of volume xxvii where a photo also appears, and it is interesting to compare the growth of the youngsters in the above picture taken a little over three years later. Unfortunately Major Stockley does not give the measurements. EDS.]

No. IX.—NOTES ON THE KASHMIR STAG (*CERVUS HANGLU*)

(*With a photo*)

I enclose a photo of 'Buddhu,' a Kashmir stag in Col. Ward's paddock at Pandrethan in Kashmir. A photo of 'Buddhu' was published in No. 2 of volume xxx of the Journal with Col. Ward's article on the 'Game of Kashmir'. Col. Ward's photo was taken in March, 1923, while mine was taken in September, 1925 while the horns were still in velvet. Both photos show the persistence of the long trez tines.

I have noticed a lot of heads with trez tines of this type on the mountains north and west of the Liddar Valley, and in Tralrukh, though they seem very rare elsewhere.

I think this is evidence in favour of the supposition that stags keep to restricted localities, and inhabit the same stretch of country throughout the year.

I myself know of three places where stags in velvet are to be found in summer, and these are widely separated in different parts of the Kashmir Valley.

The old idea that the barasingh all moved westwards towards the Kishenganga in March or April, and returned eastwards in September is no longer tenable.

C. H. STOCKLEY,
Major.

No. X.—LIST OF CETACEANS TAKEN IN TRAVANCORE FROM 1902 TO 1925

Students of Indian Cetaceans were for a long time indebted to the late Mr. Harold Ferguson, F.L.S., F.Z.S., etc., the Scientific Director, Museum and Public Gardens, Trivandrum, for the energetic work done in adding to our knowledge of hitherto unobserved forms from the Travancore sea-board. During his connection of 24 years with the Museum, he had contributed a series of articles, based on personal observations, on birds and their nidification, reptiles, and amphibians, and their metamorphoses and also butterflies, etc. As however he retired in 1904 owing to ill-health and was unable to work out the remaining sections of the animal kingdom, so far as they have been represented in the Museum, it is hoped that the present paper on the Travancore cetaceans, may be regarded as a further contribution to the Journal of the Bombay Natural History Society.

Order—CETACEA

Suborder—MYSTACOCÆTI

Family—*Balænidæ* (Fin-whales)

1. *Balænoptera indica.* The great Indian Fin-whale. This cetacean was stranded in 1901 in an advanced state of decomposition at Rajakamangalum, 5 miles south of the Muttum lighthouse, on the coast-line between Colachel and Cape Comorin. It was buried on the beach by order of the Travancore Government and was exhumed in March 1904, with the result, that the skull

and the mandibles, forty-four vertebræ and six ribs (one of which was 6 feet long), the humerus, the ulna and radius with fragments of the metacarpal and chevron bones, were obtained. For want of exhibition space in the Museum, the bones were not set up, though the two halves of the lower jaw, 18 feet 3 inches each, have been displayed, mounted side by side, on the western portico of the Museum building.

According to Blanford's Mammalia (F. B. I. series) the lower jaw of a specimen said to be 84 feet long measured nearly 21 feet.

Suborder—ODONTOCÆTI

Family—*Delphinidæ* (Toothed Whales)

2. *Tursiops catalanta* (Syn. *T. fergusoni*) The australian Bottle-Nose. February 1902. Length 8 feet 1 inch.

Dr. Blanford describes only one species of *Tursiops*, namely *T. tursio*, from which the present animal differs in the widely separated pterygoids and the dentition, which is $\frac{25}{25}$ instead of $\frac{22}{22}$. It was described by Dr. Gray on the evidence of two skulls obtained from the north-west coast of Australia by Mr. Y. Macgillivray, and has been found to be not uncommon along the Trivandrum coast.

3. *Tursiops gilli*.

Rare, a solitary specimen was obtained in 1904. Being a type specimen, it was made over to the S. Kensington Museum with a skeleton and colour sketches taken in the flesh. It is said to be found on the Pacific coast of North America and described on the evidence of the skull, and only known in the flesh by ' momentary observations taken by Scammar.'

4. *Tursiops dawsoni*. Dawson's Dolphin—two specimens were purchased in February 1908. They were 9 feet and 9 feet 4 inches respectively, and differed from all other species of *Tursiops*, in the dentition and the number and characters of the ribs.

5. *Neomeris phocænoides*. The little Indian Porpoise—Fairly common during certain seasons of the year at Trivandrum and the northern parts.

Several specimens of the Little Indian Porpoise were purchased in 1908 for comparative study. Of these, one obtained in June, while agreeing with the typical Indian Porpoise (*Neomeris phocænoides*) in many respects, differed in the purplish red patches on the lips and throat which were replaced by pale grey of corresponding size and shape and also in the dental and vertebral formulæ which are as follows :—

Neomeris phocænoides :

Teeth $\frac{18}{18}$ and $\frac{18}{18} = 36$ and 36
Vertebræ. C. 7 ; D. 13 ; L. 13 ; C. 26 = 59.

The present specimen :

Teeth $\frac{20}{19}$ and $\frac{21}{20} = 39$ and 41.
Vertebræ. C. 7 ; D. 14 ; L. 12 ; C. 26. = 59.

Of the 14 pairs of ribs 7 are double headed.

As nothing of decisive importance could be inferred in these respects with regard to the new specimen, Mr. Lydekker has preferred to leave it unnamed for the present.

6. *Delphinus delphis*. The common Dolphin. Not uncommon. It is said to have been recorded for the first time from the Madras coast.

7. *Sotalia lentiginosa* (Syn. *Sotalia fergusoni*). The speckled Dolphin.

An immature animal was obtained in 1903 and though it resembled *Sotalia lentiginosa* in many respects, the absence of pear-shaped flecks on the body and certain other characteristics, led Mr. Lydekker of the British Museum to provisionally call it *S. fergusoni* ; but when in August 1908 another animal measuring 7 feet 2 inches was also sent, he arrived at the conclusion that this was the adult of what he once described as *Sotalia fergusoni*.

8. *Pseudorca crassidens*. The False Killer. Length 16 feet 10 inches, stranded on the Trivandrum beach in February 1902. Subsequently immature ones measuring 11 feet 10 inches and 10 feet 9½ inches, respectively at Trivandrum, and adults at Rajakamangalum and Tengapatam, were also recorded. It is said to be described by Owen, on the evidence of a skeleton, found on the Lincolnshire fens.

Family—PHYSETERIDÆ

9. *Kogia breviceps*. The small Sperm-whale.

When I was at Trivandrum in February last I had occasion to observe this specimen, a gravid female of about 10 feet in length ; there was another one of the same species which was immature. It is described in Blanford's Fauna of British India, Mammalia, on the evidence of an immature female, captured at Vizagapatam ; it is recorded for the first time from the Trivandrum sea-coast.

31st March, 1925 R. SHUNKARA NARAYAN PILLAY,
C. M. Z. S.

No. XI.—A LIST OF BIRDS OBSERVED IN THE BHELING VALLEY, TEHRI GARHWAL, APRIL 1, 1926 TO MAY 25, 1926, FROM 2,000 FEET TO 13,000 FEET

6. Himalayan Jungle-Crow (*Corvus coronoides intermedius*).
23. Western Yellow-billed Blue Magpie (*Urocissa flavirostris cucullata*).
26. Indian Tree-Pie (*Dendrocitta rufa rufa*).
28. Himalayan Tree-Pie (*Dendrocitta sinensis himalayensis*).
35. Black-throated Jay (*Garrulus lanceolatas*).
38. Himalayan Jay (*Garrulus bispecularis bispecularis*).
43. Himalayan Nutcracker (*Nucifraga caryocatactes hemispila*), not seen below 9,000 ft.
45. Red-billed Chough (*Pyrrhocorax pyrrhocorax*) observed on April 16, at 8,000 ft.
51. Kashmir Grey Tit (*Parus major kashmiriensis*).
57. Green-backed Tit (*Parus monticolus*).
61. Red-headed Tit (*Ægithaliscus concinna iredalei*).
82. Simla Black-Tit (*Lophophanes rufonuchalis rufonuchalis*).
114. Himalayan White-crested Laughing-Thrush (*Garrulax leucolophus leucolophus*).
White-throated Laughing-Thrush (*Garrulax albogularis whistleri*).
927. Himalayan Whistling-Thrush (*Myiophoneus horsfieldi temminckii*).
295. Black-headed Sibia (*Lioptila capistrata capistrata*).
385. Punjab Red-vented Bulbul (*Molpastes hæmorrhous intermedius*).
386. White-cheeked Bulbul (*Molpastes leucogenys*).
425. Cinnamon-bellied Nuthatch (*Sitta castaneiventris cinnamoventris*).
439. Himalayan Black Drongo (*Dicrurus macrocercus albirictus*).
632. Bay-backed Shrike (*Lanius vittatus*).
653. Indian Scarlet Minivet (*Pericrocotus specious speciosus*).
689. Indian Oriole (*Oriolus oriolus kundoo*).
727. Common Myna (*Acridotheres tristis tristis*).
784. Indian Paradise Flycatcher (*Terpsephone paradisi paradisi*).
799. Baker's White-throated Fantail Flycatcher (*Rhipidura albicollis stanleyi*).
803. Northern Indian Pied Bush-Chat (*Saxicola caprata bicolor*).
841. Western Indian Redstart (*Phœnicurus ochrurus phœnicuroides*).
916. Himalayan Missel Thrush (*Turdus viscivorus bonapartei*). Young had left the nest on May 21 at 6,500 ft.
930. Large Brown Thrush (*Zoothera montieola*).
935. Brown Dipper (*Cinclus pallasi tenuirostris*) observed right up to the glacier.
1072. Crested Bunting (*Melophus melanicterus*).
1091. Hodgson's Striated Swallow (*Hirundo daurica nepalensis*). Building nest under overhanging rock at 4,000 ft. on May 23.
1101. Grey Wagtail (*Motacilla cinerea melanope*).
1199. Purple Sunbird (*Cyrtostomus asiaticus asiaticus*).
1258. Scaly-bellied Green Woodpecker (*Picus squamatus squamatus*).
1277. Western Himalayan Pied Woodpecker (*Dryobates himalayensis*).
1283. Fulvous-breasted Pied Woodpecker (*Dryobates macei macei*) observed at 6,500 ft.
1335. Great Himalayan Barbet (*Megalæma virens marshallorum*).

1372. Himalayan Pied Kingfisher (*Ceryle lugubris guttulata*).
1373. Common Indian Kingfisher (*Alcedo atthis bengalensis*).
1390. Indian White-breasted Kingfisher (*Halcyon smyrensis fusca*).
Hoopoe (*Upupa epops* sub-sp ?) observed in a snow storm at 7,000 ft. on April 11.
1429. Blyth's White-rumped Swift (*Micropus pacificus leuconyx*).
1472. Asiatic Cuckoo (*Cuculus canorus telephonus*).
1478. Common Hawk Cuckoo (*Hierococcyx varius*).
1521. Rose-ringed Paroquet (*Psittacula torquata*).
1522. Western Blossom-headed Paroquet (*Psittacula cyanocephala cyanocephala*).
1594. Black Vulture (*Torgos calvus*).
1596. Himalayan Griffon (*Gyps himalayensis*).
1602. Smaller White Scavenger Vulture (*Neophron percnopterus ginginianus*).
1603. Eastern Bearded Vulture or Lammergeyer (*Gypaëtus barbatus grandis*).
1689. Kestrel (*Falco tinnunculus tinnunculus*).
1695. Bengal Green Pigeon (*Crocopus phœnicopterus phœnicopterus*).
1724. White-bellied Pigeon or Snow-pigeon (*Columba leuconota leuconota*) Five seen at 4,000 ft. on April 5 and a flock at 5,000 ft. on April 7. Observed almost daily between 8,000 and 10,000 ft. between April 26 and May 4.
1726. Speckled Wood-Pigeon (*Dendrotreron hodgsoni*). A fair number about in the jungle at 6,000 ft. from May 17 to 21.
1736. Indian Rufous Turtle Dove (*Streptopelia orientalis meena*), Breeding at 6,500 ft.
1738. Spotted Dove (*Streptopelia chinensis suratensis*).
1741. Little Brown Dove (*Streptopelia senegalensis cambayensis*).
1743. Indian Ring-Dove (*Streptopelia decaocto decaocto*).
1776. Cheer Pheasant (*Catreus wallichii*).
1777. Koklas Pheasant (*Pucrasia macrolopha macrolopha*). 6 eggs taken at 8,000 ft. on May 15.
1783. White Crested Kalij (*Gennæus hamiltonii*).
1794. Monal (*Lophophorus impejanus*) very numerous, but never observed below 8,000 ft.
1825. Common Hill Partridge (*Arboricola torqueola torqueola*). 6 eggs taken at 8,000 ft. on May 14.
1842. Northern Indian Black Partridge (*Francolinus francolinus asiæ*). One seen as high up as 6,300 ft.
1918. Red Wattled Lapwing (*Lobivanellus indicus indicus*).
1980. Woodcock (*Scolopax rusticola rusticola*), seen every evening between 8,000 and 9,000 ft. from April 26 to May 15.
1982. Solitary Snipe (*Gallinago solitaria*), a couple seen at 9,000 ft. on April 27.

N.B.—This list is of necessity very incomplete owing to the writer's inability to identify a host of birds, particularly warblers, finches, pipits and the *falconidæ*, etc.

ROORKEE (U. P.),
July 7, 1926.

E.E.G.L. SEARIGHT,
Captain, R.E.

[Commenting on the above Mr. A. E. Jones, whose comprehensive 'List of Birds found in the Simla Hills, 1908–1918' appeared on page 601 of vol. xxvi, writes as follows : 'This list is very interesting as it covers country adjacent to the Simla Hills and includes some few species which I have never met in these parts though the *Fauna* does include Simla in their respective habitats, i.e. (425) Cinnamon Bellied Nuthatch and (653) Indian Scarlet Minivet. While most of the above have now come into my list, I have no record of (45) Red-billed Chough or (1726) Speckled Wood Pigeon. The Hoopoe, unless Capt. Searight collected specimens, would probably be *Upupa epops epops*.'

For the sake of uniformity the numbers used with Capt. Searight's list are those of Stuart Baker's *Handlist of Birds of the Indian Empire*. For further notes on the birds of this locality we would refer members to page 495, vol. xxv, *Birds' Nesting in the Bhillung Valley, Tehri, Garhwal,* by W. H. Matthews. Eds.]

No. XII.—ASSAMESE NAMES OF CERTAIN BIRDS USED IN NOWGONG DISTRICT

I give below a list of the names of certain birds in Assamese, collected by me for Mr. Stuart Baker during three years in the Nowgong District. They may be of use to you.

There is a mistake in the list of names of birds in Manipuri, published in the Journal (vol. xxviii) December 30, 1921. '*Tharoichabi*' in Manipuri means the Open-bill (*Anastomus oscitans*), not the Spoonbill (*Platalea leucorodia*). I have never seen a Spoonbill in Manipur in eleven years' residence.

7. Jungle Crow (*Corvus coronoides andamanensis*) = dhorā kāori.
11. Indian House Crow (*Corvus splendens splendens*) = pāti kāori.
17. Magpies, generally = erā charāi.
438. Black Drongo (*Dicrurus macrocercus*) sub-sp ? = phenchu.
459. Racket-tailed Drongo (*Dissemurus paradiseus grandis*) = bhimrāj.
685. Black-headed Oriole (*Oriolus indicus* ss ?) = sakhiati.
695. Hill Mynas, generally = rupā kani moinā, sonā kani moinā, chutiyā sālikā.
727. Common Myna (*Acridotheres tristis tristis*) = sālikā, ghor sālikā.
734. Pied Myna (*Sturnopastor contra contra*) = kān kurikā.
863. Magpie Robin (*Copsychus saularis saularis*) = dari kātārā.
1032. Common Sparrow (*Passer domesticus indicus*) = ghor charikā, ghan charikā.
1073. Swallows, Martins generally = teltupi.
1095. Wagtails, generally = bālimāhi, tipochi.
1101. Grey Wagtail (*Motacilla cinerea melanope*) = haldiyā bālimāhi.
1258. Woodpeckers, generally = bārhoitokā, (kāt kātārā, Kamrup).
1353. Crimson-breasted Barbet (*Xantholœma hœmacephala indica*) = hetulukā.
1358. Burmese Roller (*Coracias bengalensis affinis*) = kwachā kāori.
1402. Hornbills, large = rāj dhanesh, huwong.
1405. Small Indian Pied Hornbill (*Anthracoceros coronatus albirostris*) = kāo dhanesh.
1451. Nightjars, generally = itākholi.
1495. Malay Kœl (*Eudynamis scolopaceus malayana*) = kuli.
1509. Common Coucal (*Centropus sinensis sinensis*) = kukuhā, dābahi kukuhā.
1535. Owls, generally = phenchā.
1595. Vultures (*Vultur*, *Gyps*) = sagun.
1635. Fish Eagles, generally = Kurnā chilāni.
1641. Brahminy Kite (*Haliastur indus indus*) = rangā chilāni.
1642 Common Pariah Kite (*Milvus migrans govinda*) = mugā chilāni.
1643. Kites, generally = chilāni (chilā in Kamrup District).
1645. Harriers, generally = sen.
1665. Hawks, generally = sen chilāni.
1695. Green Pigeons, generally = hāithā, hāithak (hāithal, Kamrup).
1710. Imperial Pigeons, generally = porgumā.
1719. Emerald Dove (*Calophaps indica*) = sil kopu.
1733. Doves generally = kopu (kopati, Kamrup).
1737. Indian Turtle Dove (*Streptopelia orientalis agricola*) = hāruā kopu.
1738. Indian Spotted Dove (*Streptopelia chinensis suratensis*) = pāti kopu, kupo.
1741. Little Brown Dove (*Streptopelia senegalensis cambayensis*) = rām kopu.
1743. Indian Ring-Dove (*Streptopelia decaocto decaocto*) = set kopu.
1744. Indian Red Turtle-Dove (*Œnopopelia tranquebarica* ss ?) = hāruā kopu.
1761. Common Peafowl (*Pavo cristatus*) = moirā.
1764. Indian Peacock-Pheasant (*Polyplectron bicalcaratum bicalcaratum*) = deodorik.
1768. Indian Jungle-Fowl (*Gallus gallus gallus*) = ban kukurā.
1786. Black-breasted Kalij Pheasant (*Gennœs horsfieldi horsfieldi*) = dorik.
1816. Quails, generally = batar.
1825. Hill Partridges, generally (*Arboricola*) = duboi.
1844. Black Partridge (*Francolinus francolinus melanonotus*) = mechenteri.
1851. Swamp Partridge (*Francolinus gularis*) = koirā.
1865. Rails, generally = dalmurā.

1884. Chinese White-breasted Water-Hen (*Amaurornis phœnicura chinensis*) = pāni duboi.
1888. Purple Coot (*Porphyrio poliocephalus poliocephalus*) = kām charāi.
1895. Sarus Crane (*Megalornis antigone antigone*) = korchon.
1903. Bengal Florican (*Sypheotides bengalensis*) = ulumoirā (the peacock of the 'ulu' grass).
1918. Red-wattled Lapwing (*Lobivanellus indicus* ss ?) = bālighorā, tetetuā.
1980. Snipes, generally = kārchelekā, pungā.
2027. Pelicans = dherā (bhelā, Kamrup).
2034. Cormorants, generally = pāni kāori.
2037. Indian Snake-Bird (*Anhinga melanogaster*) = maniori, bhejiagoi.
2049. White Ibis (*Threskiornis melanocephalus melanocephalus*) = bogā akohi bog.
2050. Black Ibis (*Inocotis papillosus papillosus* = kalā akohi bog.
2053. Indian Spoonbill (*Platalea leucorodia major*) = khantiyā bog.
2057. Indian White-necked Stork (*Dissoura episcopa episcopa*) = kunuā.
2059. Black-necked Stork or Jabiru (*Xenorhynchus asiaticus asiaticus*) = teliā hāreng.
2061. Indian Marabout or Smaller Adjutant (*Leptoptilus javanicus*) = bor tokolā.
2063. Open-bill (*Anastomus oscitans*) = sāmuk bhangā = 'snail breaker'.
2064. Herons, generally = koi.
2070. Egrets, generally = bog.
2070. Large Egret (*Herodias alba alba*) = bor bog.
2073. Small Egret (*Herodias garzetta garzetta*) = teteri bog.
2074. Cattle Egret (*Bulbulcus ibis coromandus*) = Jobogali.
2077. Indian Pond Heron (*Ardeola grayii*) = konā muchuri.
2086. Black Bittern (*Dupetor flavicollis flavicollis*) = khāirā bog.
2097. Cotton Teal (*Nettopus coromandelianus*) = nākor kerkechuwā.
2099. Grey Lag Goose (*Anser anser*) = rājhāns, dhitrāj.
2105. Bar-headed Goose (*Anser indicus*) = rājhāns, bogā rājhāns (= white goose).
2107. Lesser Whistling Teal (*Dendrocycna javanica*) = sorāli.
2110. Ruddy Sheldrake or Brahminy Duck (*Casarca ferruginea*) = chākoi chākowā, rāmkāon.
2111. Mallard (*Anas platyrhyncha platyrhyncha*) = āmroliyā hāns, banariyā pāti hāns.
2112. Spot-bill (*Anas pœcilorhyncha pœcilorhyncha*) = bor mugi hāns.
2116. Gadwall (*Chaulelasmus streperus*) = saru mugi hāns.
2117. Wigeon (*Mareca penelope*) = kathiyā kundā.
2119. Common Teal (*Nettion crecca crecca*) = kalimuri, ghilā hāns.
2121. Pintail (*Dafila acuta*) = nejāl hāns, lighal neji (= long tail).
2122. Garganey Teal (*Querquedula querquedula*) = ghilā hāns.
2123. Shoveller (*Spatula clypeata*) = khantiyā hāns (cf. spoonbill), nāk dangarā (= big nose).
2125. Red-creasted Pochard (*Netta rufina*) = deo hāns.
2126. Common Pochard (*Nyroca ferina ferina*) = rangā muriyā (= red head).
2127. White-eyed Pochard (*Nyroca rufa rufa*) = kalimuri (cf. common teal).
2130. Tufted Pochard (*Nyroca fuligula*) bāmuniyā hāns (= the brahmin, from his tuft like the Brahmin's lock of hair).

Note.—In Assamese, 'ch' is pronounced as the English 's', while 's' is pronounced as the Highland 'ch', a kind of guttural aspirate.

These names were collected partly from fishermen and cultivators, and partly from a well-educated Brahmin, who was interested in sport and natural history. They were all checked by the latter.

J. C. HIGGINS, I.C.S.

THE RESIDENCY,
IMPHAL, MANIPUR STATE.
July 10, 1926.

No. XIII.—OCCURRENCE OF THE INDIAN COURSER (*CURSORIUS COROMANDELICUS*) AT PANCHGANI

Both Jerdon and Oates give the distribution of this bird as inhabiting the greater part of the Indian Peninsula excepting Lower Bengal and the Malabar Coast. It is also said to be very abundant in the Deccan on open dry plains

TYPICAL BREEDING GROUND OF *Caprimulgus monticolus* AND *C. europæus unwini*. SETHI, JHELUM DISTRICT, PUNJAB SALT RANGE (ALT. 2,600 FEET.)

Caprimulgus europæus unwini, SITTING ON EGGS (AT THE FOOT OF THE BUSH IN THE CENTRE OF THE PHOTOGRAPH). SETHI, JHELUM DISTRICT, PUNJAB SALT RANGE (ALT. 2,600 FEET), 2ND JULY, 1926.

away from forest, but no mention is made as to the altitude this bird goes up to. In early March of this year I had the good fortune of observing a single pair of these birds on the Tableland at Panchgani, the altitude of which is 4,300′. This pair remained on the Tableland for two days and were never seen again after that. I have been observing animal life in Panchgani for three years but never came across these birds before at any season.

It would be interesting to know how high these birds go in other localities.

BOMBAY NATURAL HISTORY SOCIETY,
6 APOLLO STREET,
September 3, 1926.

C. McCANN.

No. XIV.—NOTE ON THE BREEDING OF THE GENUS *CAPRIMULGUS* (*NIGHTJARS*) IN THE PUNJAB SALT RANGE

(*With a Plate*)

A few years ago Mr. Hugh Whistler drew attention to our lack of knowledge of the Nightjars of the Punjab (*Jour., B .N. H. S.,* vol. xxvii, p. 363) and in response to his appeal for further information I venture to place on record what I have so far observed of the breeding of these birds in the Salt Range.

The species met with in the Range are *C. mahrattensis, C. monticolus,* and *C. europæus unwini,* and all three of them breed there.

Sykes' Nightjar, *Caprimulgus mahrattensis.*

This species is apparently confined to the broken ground along the southern base of the Range, and I have never found it, nor its eggs, in the hills. The country is mostly stony waste, diversified with occasional stretches of hard, bare soil and a succession of boulder-strewn, torrent beds, most of them dry, but some with a small stream of brackish water. The vegetation consists chiefly of stunted 'Jahl' trees (*Salvadora oleolides*) and 'Kari' bushes (*Capparis aphylla*), and an abundance of small, bushy, plants, of which those known locally as 'Vena' (*Rhazya*) and 'Harmal' (*Peganum harmala*) are the most common. The birds spend the day in the shade of the larger trees and bushes and sally forth at dusk after the manner of their kind. I am not acquainted with their call, but when flushed during the day they utter a low chuckle.

The eggs are usually laid on stony ground at the foot of a small plant, and one clutch, from which the sitting bird was flushed, actually had a sharp-edged stone jutting up between them. These eggs were on the point of hatching, and the bird, having settled a short distance away, threw itself about and fluttered its wings much in the manner of *Glareola lactea* in like circumstances.

The usual time for eggs is March and Apirl, the earliest date on which I have secured them then being March 17, and the latest April 26, but this bird apparently breeds also at other seasons, for I have one clutch taken on the same ground on July 26.

Franklin's Nightjar, *Caprimulgus monticolus.*

This species frequents stony hills lying between two and three thousand feet, from which small ravines, well covered with 'Phulah' (*Acacia modesta*) and wild olive trees and bushes of various kinds, lead down into cultivated valleys. The hills themselves are bare, except for a small, thick-set, and thorny bush called 'Kander' (*Gymnosporia royleana*). The birds spend the day in the shade of the ravines and are on the wing as soon as it begins to get dark. The call, with which I am well acquainted, is, as noted by Mr. Osmaston (*Jour., B. N. H. S.,* vol. xxvii, p. 949) a sharp and penetrating 'choo-ee'. It is uttered both on the wing and from the ground, and sometimes from the top of a bush. It can be heard continuously all night long in June when the birds are pairing, and becomes less frequent as the season advances. It is sometimes uttered in daylight, and I have located a bird at the beginning of July by hearing its call as late as 7.0 a.m. Like *C. mahrattensis* it often gives a low chuckle when flushed during the day. On three successive nights in June a pair of these birds was watched drinking at a small pond. They appeared regularly at dusk, calling repeatedly as they came, and flew over the water, dipping down to it after the manner of swallows.

The eggs are laid on stony ground, dotted with small bushes, in close proximity to a ravine, into which the sitting bird flies when disturbed. The place selected seems invariably to be in the neighbourhood of cultivation. The eggs rest on bare ground amongst the stones, at the foot of, or fairly close to, a small bush or plant. When the hen is sitting her mate will usually be found in the shade of a ravine nearby. During the nesting season I have several times flushed as many as four male birds from one small ravine.

Eggs are to be found in June and July. The earliest date on which I have taken them is June 25, and the latest July 18, but I have seen a young bird with quills sprouting as early as June 23. The young apparently do not always remain in the same place, but move, or are moved by their parents, short distances of a yard or two from time to time. On one occasion a bird sitting beside a nestling slunk off at my approach and squatted amongst the stones a short distance away.

Two clutches of eggs almost certainly of this species, together with a clutch of *C. euroœus unwini,* were brought to me on July 6, by a villager who said that he had found them all on the 3rd near a village at the foot of the hills, i.e., on the ground where *C. mahrattensis* breeds earlier in the year, but I have no personal knowledge of the nesting in that locality of any but the last named.

There seems to be an autumn passage of these birds across the Range, as in certain localities the villagers state that they appear in large numbers in the latter half of July and August. Two birds shot in the middle of July by a Forest Guard, who probably 'browned' a party, were found to be of this species and heavy in moult. I was told of a similar passage of nightjars at this season in the neighbouring District of Rawalpindi, where they then become a quarry for the hawks of the local gentry, and was shown some of this species which had been taken thus on July 22. I was also informed that a smaller kind, presumably *C. europœus unwini,* appeared a little later and afforded better sport.

Hume's Nightjar, *Caprimulgus europœus unwini.*

This species breeds on the same ground as *C. monticolus* and its 'nest' may sometimes be found at no great distance from one of the latter. In general, however, it seems to prefer more cover, being often found on hills thickly clothed with 'Santha' (*Dodonœa viscosa*) and other bushes. This brings it more in the track of the village goat-herd and is doubtless the reason why its eggs are far more frequently discovered. Its habits are similar to those of *C. monticolus* and it also gives a low chuckle when flushed during the day. As regards the call I can say nothing definite. According to the 'Fauna' it is a whirring sound, and I have on one or two occasions heard such a sound on ground frequented by this bird. On the other hand I have several times had cause to suspect that it makes use of a note like that of *C. monticolus.* The breeding season is June and July, and nearly all the eggs in my possession have been taken during the month following June 10. I have found young in down, with the parent bird sitting beside them, on June 23, and have had half-grown young brought to me on June 26. The down of the young in this species is grey; in *C. monticolus* it is pinkish brown. The eggs are nearly always laid under the shelter of a bush, often one of fair size, and may sometimes be found on the steep and rocky side of a ravine. The foot of a 'Santha' bush is a site often selected. In one such case a bird was flushed from an egg lying on a flat stone underneath the bush. The ground all round was littered with dry 'Santha' leaves and the bird had apparently cleared the stone of them before laying her egg on it.

The Salt Range name for Nightjars of all kinds is *Chapáki;* in the neighbouring Rawalpindi District they are called *Paták.* The villagers believe that if one of these birds touches or flies over a cow or a goat the animal's milk dries up and its udder swells. The remedy is for a man who has killed a nightjar to spread his *Chadar* (loin-cloth) over the afflicted beast, which is thereby cured.

PHILLAUR, PUNJAB,
August 7, 1926.

H. W. WAITE, F.Z.S., M.B.O.U.,
Indian Police.

No. XV.—OCCURRENCE OF THE SHELDRAKE (*TADORNA TADORNA*) AND LAPWING (*VANELLUS VANELLUS*) IN UPPER BURMA

In an editorial comment in No. 1, vol. xxxi of this Journal (p. 224) it is mentioned that the Sheldrake *Tadorna tadorna* is an uncommon winter visitor to Northern India and 'is rare in Bengal but has been obtained as far east as Arakan'. It may be therefore of interest to record that on December 6, 1924 I saw some of these birds at Posagon near Paungbyin on the Upper Chindwin River. They were with a number of Ruddy Sheldrakes. On November 26, 1924, I saw on the same river south of Homalin, five Common Lapwings (*Vanellus vanellus*) which I have never before seen or heard of in Burma. They were on a jheel near Naungsankyin and were so close to me that it was quite unnecessary to identify them by shooting.

RANGOON, J. K. STANFORD, M.B.O.U.,
July 16, 1926. *Indian Civil Service.*

No. XVI.—THE MATING OF CROWS

On April 26, 1925, I observed a pair of crows (*Corvus splendens splendens*) in copulation. It was at about six o'clock in the morning on an exposed telegraph post, with a number of other crows around. The act was performed in the usual manner of birds, and I am recording this as it is the first instance of the actual act having been witnessed by me.

Prior to this I had understood—and the belief is more or less general—that the squabbles commonly seen in the breeding season, when one crow is lying on his back on the ground seemingly pinioned, and grappling with another standing over him, was the method in which the act was accomplished. It is remarkable that there should be no records on this point, considering what an aggressively common bird the crow is, and in what profusion their nests are to be found at the beginning of the monsoon. Will any member who has made similar observations, enlighten me with his experience?

BOMBAY, SALIM A. ALI
January 29, 1926.

No. XVII.—A NOTE ON THE NIDIFICATION OF THE WESTERN REEF EGRET (*LEPTERODIUS ASHA*) IN KARACHI CITY, SIND

(*With a Plate*)

I have closely observed the nidification of this species of Reef Egret in Karachi for four successive years.

For three years, season after season, the birds chose two definite sites, a straggling belt of trees bordering an old Burial Ground and a Public Garden, both situated in the heart of the native quarter of the City, about a mile away from salt water.

Both heronries were discovered early in May 1923. The site being given away by the throaty squakings of numberless fledglings clamouring for their never-ending meal of fish.

A score or so of very hard-set eggs, with which nothing could be done, were, on this occasion obtained.

During the two following years the birds again chose these sites and a large series of fresh and slightly incubated eggs was collected on March 22, 1924.

In 1926 the birds were obliged to abandon the burial ground site, which had been taken forcible possession of by large numbers of the common House Crow (*Corvus splendens*) attracted evidently by cattle tethered, for the first time, beneath the trees.

Pipal (*Ficus religiosa*) and Ber (*Zizyphus jujuba*); Portia (*Thespesia populnea*), Inga Dulcis (*Pithecolobium dulce*) and Jamblo (*Eugenia jambolana*) were the trees chosen by nesting birds, the first two being particularly favoured.

Nim (*Azadirachta indica*) trees were left severely alone for nesting sites, though some birds were noticed carrying small dried twigs off which the leaves had fallen.

Generally speaking birds paired off and commenced building during the first week in March. Courting preliminaries consisted of the male offering his mate a freshly picked leaf or twig, which was accepted, played with and then allowed to fall to the ground. This performance would be repeated again and again, till the birds evidently tiring, would remain perched close to one another and at intervals preen themselves.

Early birds were content with building an ordinary, typically heron-like stick nest on the tree chosen by them, but numbers of birds building on *Pipal* after the appearance of new leaves, constructed a leafy and unique type of nest, photographs of which are appended.

Both types of nest vary in bulk and shape and consist of a fairly stable, platform-like structure of sticks lined with green leaves upon which three to four eggs are laid. The birds are of uncleanly habits and nests after a week's occupation have anything but a sanitary odour or appearance.

In the third week most birds were found sitting close on young or hard sat eggs, and by the end of the fourth week numbers of fledglings were seen sitting loutishly on the edges of their nests eagerly awaiting their diet of disgorged and evil smelling sprats.

Great excitement and a general uproar of throaty squaks, harsh quacks, hoarse gurglings and high pitched screams accompanied by a furious flapping of wings noisily heralded the arrival of every bird returning to the colony with a well-filled gullet of fish to appease the voracious appetite of its offspring.

On March 19, 1924, being unable to obtain a climber, I sat and observed a pair of slate-blue birds for the best part of an hour and the following is a polished extract of the note then made :—

'Most of the time was spent perched close together in idle contemplation. At intervals first one and then the other would preen itself. After about twenty minutes of this alternate dozing and preening, one lazily flapped its wings, stepped awkwardly about the branches, and after apparently choosing a suitable nesting site, crouched there with neck doubled in, till joined shortly after by its pair, which after inspecting the place and making several idle pecks at the twigs around, quietly crouched down, sitting cheek by jowl with its mate.

Thus they sat, at intervals either preening themselves, pecking lazily at their toes or surrounding twigs or quickly opening and shutting their bills, after the manner of storks when clicking their beaks.

Eventually they scrambled one after another to the topmost branches of the Ber tree where they once again perched in moody silence.'

When I left the heronry about an hour later, this couple was still seated as they had last been observed and some days later when I again visited the colony a bird was sitting close on a nest placed near the spot which the birds, under observation, had inspected on the 19th.

Though it cannot be positively stated that this bird was one of the pair formerly observed, still the presumption does arise and the grounds for its consideration are, at all events, reasonable.

During my visits to the heronries birds were often seen mating, the female passive, crouching low on the branch across which she sat, while the male completed the act with the usual flapping of wings.

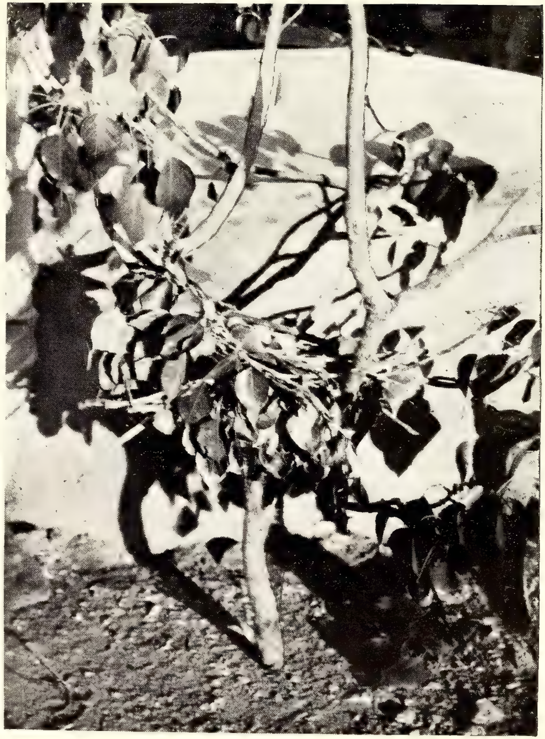
I quote below a note made on March 19, 1924 :—

'Visited the heronry where about two hundred birds were nesting amongst the topmost branches of lofty Pipal trees.'

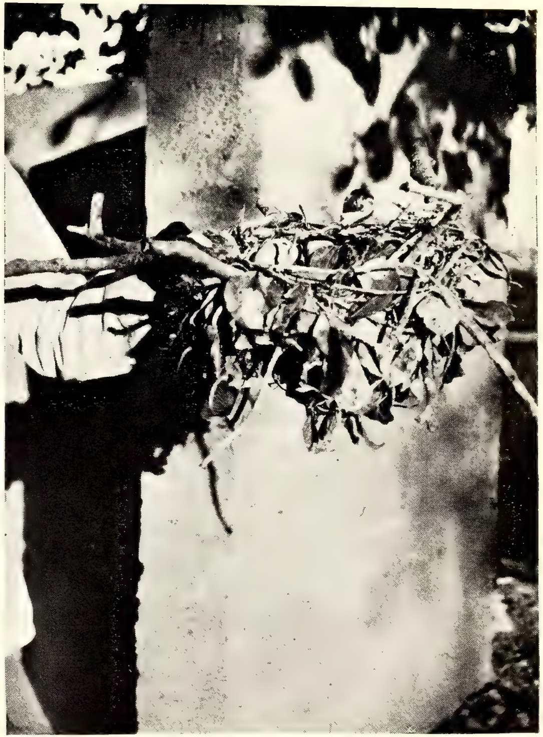
A few nests however were placed in Jamblo, Ber and Inga Dulcis trees.

The majority of birds were slate, not more than a dozen pairs of the white variety being noticed. About half the colony was sitting close, the remainder busy building, nests being well advanced. Nests on Pipal were, in most cases, made from Pipal branches *with the leaves still on.* Freshly built nests had a most singular appearance, the green leaves forming a sort of curtain to the framework of the nest, which was in most cases completely hidden from view. As the branches aged and decayed, the leaves withered and gradually fell off exposing the stick structure of the nests.

Birds were observed in the act of building and carrying small branches of Pipal bearing leaves. In all cases the male, presumably, collected the building material and carried it to the female who either rejected or accepted it. She would remain perched on the chosen site while he flew off and deliberately broke, at times after considerable labour, a small green Pipal branch with which he flew to within a few feet of her. Two, three or more ungainly hops and flaps then brought him to her. She with neck outstretched, would take the branch from his beak, and if approved of would forthwith place it in



NEST OF *Lepterodius asha* DEPICTING LEAFY TYPE WITH LEAVES STILL FAIRLY FRESH



THE SAME, SHOWING LEAF CURTAIN GRADUALLY FALLING OFF OWING TO LEAVES WITHERING AND DROPPING

position, he flying off for another, leaving her perched with neck drawn in or pecking gently at the newly arranged branch.

If she happened to reject a branch she held it horizontally in her beak and worked her hold along it, as if testing it, by a series of quick, short jerks, ultimately allowing it to fall to the ground. The male looking foolishly on, would then fly despondently off to make a better selection.'

The eggs of the Western Reef Egret are as described in 'Nests and Eggs of Indian Birds', volume iii, 2nd edition. Some eggs though are a rich greeny blue, a shade quite distinct from the normal pale blue egg generally laid by this species.

The eggs of a clutch were usually similarly shaded, though on one occasion out of a dozen nests I found a clutch of three containing one dark and two light coloured eggs. I never found more than four eggs or young in a nest, generally three. Once a nest contained an unusually small and two normal eggs. The former was addled while incubation in the latter was well advanced. I succeeded however in blowing the eggs which are at present in my collection.

I have never found this egret breeding in company with others.

Parent birds robbed of their eggs deserted their nests, the sticks of which were in most cases appropriated by others.

In all cases observed white birds paired with white and slate with slate. The young in each case taking after their parents. The fledglings of these two varities are a dirty white and a dirty slate grey respectively. As they grow to maturity the plumage of the former changes to white and that of the latter to slaty grey with the breast and abdomen feathers lighter than those of the back and upper wing coverts.

Birds which I take to be fully grown adults are either a pure white or dark inky blue, with a white throat patch. The variability in the size of the adult of this species is very noticeable.

Many breeding birds, fully crested and plumed, were found to be much smaller and of an apparently lighter build than the normal, which is a fairly large sized bird.

Slate birds, presumably not fully grown, with a few white secondaries or tertiaries in either one or both wings are not unfrequently to be seen. Adults of both sexes carry crests and plumes during these breeding season.

The colouring of soft parts, bills and legs is anything but constant; the eyes without exception yellow.

Year after year I have seen slate birds with dashes of white in either one or both wings. Personally I am of the opinion that this partial albinism or pied condition is only temporary and confined alone to young birds as I have never found it occurring in the large, aged, dark inky blue variety.

Though slate and white birds have been said to interbreed in captivity I am of the opinion that in their natural environment, where selection is unrestricted, this very seldom, if at all, occurs. My observations during four years have never led me to believe otherwise.

The building and rearing season of birds under observation extended approximately over a period of three months, from March to early June.

Local fishermen tell me that birds breeding in the mangrove swamps do not commence building till May. A reliable man sent to the swamps on the 15th of March reported that numbers of birds had been seen but none found building. I hope, this year, to be able to observe the nidification of this species in the Karachi Swamps.

My thanks are due to Mr. Chatterji, Superintendent of the Gardens, through whose interest and courtesy I was able to secure snapshots of nests, which had to be cut down in order to be effectively photographed.

KARACHI,
April 14, 1926.

K. R. EATES,
Sind Police, Karachi City.

No. XVIII.—BREEDING OF THE GREAT HIMALAYAN BARBET (*MEGALÆMA VIRENS MARSHALLORUM*) IN THE PUNJAB SALT RANGE

The Great Himalayan Barbet is to be seen, and heard, in the fruit gardens at Choa Saidan Shah (2,000 feet), in the Jhelum portion of the Salt Range, throughout the year, but I have only this year been able to make certain that it breeds there. On June 5, I shot a male calling from the branch of a large mulberry tree in one of the gardens, and subsequently discovered a nest hole in the lower side of the branch, at a short distance from the main trunk and a height of about 20 feet from the ground. A few blows on the branch below the hole caused a young bird to fly out, and two more were found inside when the hole was opened out on the following day. They were almost ready to fly and would probably have left the nest in a week or so.

PHILLAUR,
June 15, 1926.

H. W. WAITE, F.Z.S., M.B.O.U.,
Indian Police.

No. XIX.—EXTRAORDINARY TAMENESS OF THE GARGANEY TEAL (*QUERQUEDULA QUERQUEDULA*)

In 'Indian Ducks and their Allies' the distinguished author does not appear to be quite clear as to whether to class the Gargany Teal as a tame or a wild bird. In view of this an experience of mine may prove interesting.

Last March I was marching into a shooting block in the Mandla District of the Central Provinces when I came across five Garganeys, two males and three females on a circular 'talao' only about thirty yards in diameter. I watched them for some time but although they could see me perfectly, there being no kind of cover and I was carrying a rifle, (which, after all, to a duck must look very like a shotgun,) they made no attempt to move. Presently I went and sat down right at the edge of the talao, not twenty-five yards from them. They only flew round the talao once and then settled again. A month later, on my way back, their number had increased to nine and they were even tamer than before. Such extraordinary tameness on the part of migratory birds is incomprehensible to me. There were plenty of small talaos round about to which they could have gone.

By the way, 'Indian Ducks and their Allies' makes no mention of the peculiar noise, resembling a watchman's rattle, that Gargany make when on the wing.

RAZANI, WAZIRISTAN,
June 30, 1926.

J. Mc. C. CLIVE,
Captain.

No. XX.—THE RED-LEGGED FALCONET (*MICROHIERAX EUTOLMUS*) HAWKING BUTTERFLIES

The 'Fauna of British India' records that the falconets principally prey upon insects but I do not think that it has ever been recorded that they catch butterflies. On August 16, 1925, at Esauk in the Shwebo District, Upper Burma, I was standing on the steps of a rest-house watching a red-legged falconet (*Microhierax eutolmus*) which was perched on a dead branch of a high tree. It launched itself into the air and with incredible speed flew under the bungalow beneath my feet and carried something up to the same perch from which it had started. It ate what it had caught and the wings floated to the ground. I picked them up and found that they were the wings of a butterfly—*Papilio demoleus*. I saw it catch two of these butterflies. There is something very appropriate in this exquisite little falcon hawking butterflies.

SYLVAN LODGE,
MAYMYO, UPPER BURMA,
March 29, 1926.

S. F. HOPWOOD,
I.F.S.

[Butterflies are not often hawked by birds, though moths of course are, and it would be interesting to know whether this falconet systematically hawked them—and as a species does so,—or the instance quoted was only an individual idiosyncrasy. The late Mr. E. H. Aitken was of opinion that butterflies are left so much alone by birds not because birds do not like them as food but, because being all wings and no body, every bird soon finds out that they are not worth the trouble of catching. He says (vol. xvi, p. 156): 'The peculiar zig-zag flight of a butterfly makes it very difficult for even a king-crow or a bee-eater to capture one on the wing, and when it thinks it has succeeded it gets a mouthful of wings and misses the body. . . . The flight of a moth is straight and offers little difficulty, accordingly a moth can scarcely show itself by daylight without being pursued.'

Summing up his interesting and instructive 'Field Observation on the Enemies of Butterflies in Ceylon' (*Proc. Z. S.*, September 1913) Mr. J. C. Fryer after quoting a number of observations from his diary concludes that

(i) Butterflies do not form any large percentage of the food of the more common birds in Ceylon.

(ii) With the exception of the Swallow-Shrike (*Artamus fuscus*) birds are by no means clever in capturing butterflies.

(iii) The Swallow-Shrike is the only bird which actually lives on butterflies, and it almost always chooses butterflies of the so-called nauseous genera *Danais* and *Euplœa;* it seems however, that this preference is due to the difficulty of catching faster-flying species, and not to the superior flavour of *Danais* or *Euplœa*.

(iv) The various species of Bee-eaters, when attacking butterflies, usually choose members of the *Papilionidæ* and *Pieridæ*. EDS.]

No. XXI.—HOUSE GECKO (*HEMIDACTYLUS SP.*) SHOWS A SWEET TOOTH

Some time ago I noticed a peppermint sweet lying on the side-board which had been partially eaten or rather sucked away in parts and, as I was anxious to find out who was responsible for this improper behaviour, I left it there, and kept a watch for the culprit. To my surprise after a little waiting, I noticed a flat form moving towards the sweet. I have got it! It was no other than the ordinary house lizard. After he had been there some time, I examined the sweet, and found that he had licked hollows into the margin of the sweet.

A few days later I noticed something that looked like a tail hanging out of the sugar basin. Again my curiosity got the better of me and I endeavoured to catch this little robber in the pot: I did. It turned out to be the gecko again, in all probability the same one. I caught and examined him and found that his mouth was full of sugar and that there was also a quantity adhering to his chops which were wet with saliva. I have heard people say that they have known these lizards to eat sugar but I never had the opportunity till now of observing it for myself.

It would be interesting to know where a lizard would get his sweets under ordinary circumstances and whether they are addicted to sweets or is this an acquired character of the house lizard only?

BOMBAY, C. McCANN
August 20, 1926.

No. XXII.—COMMENTS ON FR. LEIGH'S NOTES ON SNAKES

Reading Fr. Leigh's notes on snakes in the Journal (vol. xxxi, p. 227), I would like to make the following remarks with regard to the Russell's Viper squirting its poison. As the poison is harmless unless it gets into the blood, either through a bite or a wound, there would be no object for the snake to acquire the habit of squirting its poison. The snake in question was seized at the time. The undermentioned reasons might therefore enable us to explain the apparent squirting of the poison :—

The snake being seized behind the head, its first inclination is to open its mouth and also to inflate itself (being vexed). The grip of the person holding the snake may in this case have been high up pressing on the poison gland which would naturally cause the venom to flow to the tip of the fang, (this does occur when the snake is caught) and the exhalation of air (which is considerable in this viper) would naturally blow the poison off the tip of the fang. This has actually taken place with a specimen kept by me in St. Xavier's College, Bombay. I can hardly imagine that under natural circumstances the snake could or would squirt its poison in the manner described by Fr. Leigh. This has never come under my experience.

With regard to Fr. Leigh's attempt to drown a krait, it might be interesting to quote the following incident which took place in the same College. A

Russell's Viper which had been put into a jar of spirit an hour before a lecture commenced, was brought into the class for demonstration. On removal of the cover the snake sprang out and struck the professor in the chest. Fortunately he was not bitten and is still alive to tell the tale.

BOMBAY NATURAL HISTORY SOCIETY,
6, APOLLO STREET, C. McCANN
August 27, 1926.

No. XXIII.—PARTURITIONS OF ELECTRIC RAYS AND A SEA SNAKE IN THE MARINE AQUARIUM, MADRAS

I. Two specimens of *Astrape dipterygia* apparently received in the Aquarium in a gravid condition gave birth in February to six and four young rays respectively. Both the mothers died immediately after parturition though the young ones survived for a few hours. The latter differed in colour from the parents in the absence of the white spots.

In the first week of March, a specimen of *Narcine timlei* brought forth six young ones. Both the mother and the young continued to live apparently in good health. A thick bed of sand was provided to enable them to bury themselves with ease whenever they liked. The cord and yolk sac of each continued to remain *in situ* when they were born; nevertheless, the young rays attempted to swim in a clumsy fashion. The cord and sac were dropped after the fifth day when the young ones started to bury themselves in sand and seemed to enjoy doing this.

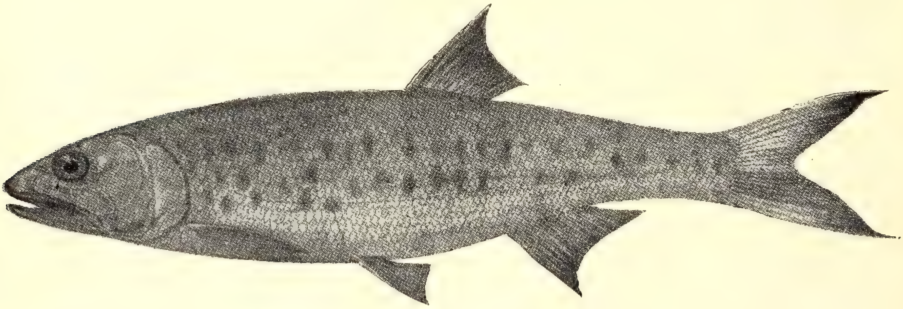
They differed in colour from the adult in the absence of the chocolate-coloured spots, so characteristic of the adult. The young ones continued to live till the 8th April when they began to die one after another.

II. One of the Hydrophiinæ or sea snakes exhibited in the Aquarium is *Distira cyanocinctus*. On the night of 7th December a snake gave birth to three young ones. It was an agreeable surprise for the members of the Aquarium staff when they found one morning three saffron-coloured and black-striped young sea-snakes swimming gaily with the other adult members in the tank. They began to feed six days after birth. The food that is usually given is chopped fish. One of the young ones died by an accident. The other two are still alive and thriving.

MADRAS. B. SUNDARA RAJ,
Director of Fisheries.

No. XXIV.—FISHING IN LONAVLA

Your attention is invited to the extracts from letters which were published in 1831—32 in the *Oriental Sporting Magazine* and which are reprinted. It is suggested that if the Indian Trout are still plentiful in the rivers of the Neemuch District an attempt might be made to stock some of the waters in the Lonavla area with this fish. The altitude of Neemuch is 1,476′ and that of Lonavla is 2,037′, whilst the distance between the two places is only 400 miles. The rainfall of the two localities shows, however, a great variation.



BARILIUS BOLA. THE INDIAN TROUT

Illustration from the 'Rod in India'

FLY-FISHING IN MEYWAR

Taking a hopeful view of the subject there is some reason to suppose that the operation, if attempted, might terminate successfully and another sport-giving fish be thus introduced into Lonavla waters.

Extracts from letters which appeared in the ORIENTAL SPORTING MAGAZINE *of 1831—32.*

'Many months have now elapsed since I wrote to you upon trout-fishing; and if my recollection fails me not, I promised that you should hear from me again. However, the prospect of a long march, and the time being rather close for our start, obliged me to defer it until now, hoping, of course, to be able to add to the epistle by so doing. It was a constant practice with those fond of the sport at Neemuch to go out between musters as often as they could get leave, which was seldom or ever refused by that fine old fellow who commanded us; and the first and second of every month were happy days for some five or six of us, who generally made all sail to get to the banks of the rivers Chumbal or Banass by breakfast time.'

'The Lind we found full of very fine trout, a few of which we caught with the fly and minnow; they are also to be taken in the Chumbal below the junction of that river.'

'The former river also abounds with very fine mullet, and in such large shoals, that eight or ten were sometimes killed at a shot; the difficulty, however, was in getting them out, and we hardly succeeded in bringing home more than a tiffin of them.'

'By April 15, this fishing is at an end; the rapids present a sad picture of what they were a month before, and I fancy the large fish must rusticate in the deep water during that melancholy season, the hot winds. The trout, however, are as eager as ever for the fly, and I think are to be taken in larger numbers at this season than any other.'

'On April 20, we returned into cantonments, having been many days without seeing a single fish. During the march of the regiment in November last year, we halted at a place named Ameerghur, and several of us took the opportunity of visiting Mungroop, a place celebrated for fishing. Here three of us killed the enormous number of 51 dozen of fine trout in one day, all of which were brought into camp by four coolies. Many of your readers will doubtless exclaim "Wah! wah!" but I assure you that several officers can vouch for the truth of this, having seen the fish brought into camp. The most extraordinary part of the business is that myself and our Neemuch Izaak did not stand twenty yards apart, or more than double that distance, to the right or left, during the time we caught upwards of nineteen dozen each, and it often happened that two and three fish were pulled out at a time.'

'The flies used were on a No. 4 hook.

The end fly—Scarlet hackle, green body, and gold twist, bustard's wings and tail.

1st drop—Red hackle, Jay's wings, bulbul's tail and legs.

2nd drop—Red hackle, wings of the golden pheasant, scarlet body, and silver twist, scarlet tail and legs.'

'Hearing from some Neemuch sporting gents just returned from your side, that you are somewhat incredulous on the point of our trout-fishing, I beg leave to send you an account of a few days' sport this season.'

'In December last, 27th and 28th, two gents each killed five and a half and six dozen each day, the general size of these fish from 8 to 14½ inches. During the months of March and April last, an old hand at the fly killed six and seven dozen for two or three days a week. Trout-fishing, in fact, is rather losing "its celebrity" at this place, as three *red hot griffs* at the work killed last month ten dozen and two trout in about three hours. The nullahs under the Jaird Hills, about twelve miles from Cantonments, swarm with these delicious fish, which come into season at the end of December, and out at the commencement of the rains.'

'The baits used are the *goorgorak,* and fly made of the gaudiest colours. There seems to be a difference of opinion as to which bait is best, though I am inclined to give a decided preference to the latter, and think that the former are only used by those who cannot use the fly.'

'We shall begin with our Neemuch fly-fishing.'

'The Goorgoora (as mentioned by a "Friend to the Art," in your February number) is of the tribe scarabæi, genus coleoptera, usual antennæ, etc.; is found along the banks of rivers and nullahs in great numbers, and of all baits he is the most repulsive and disgusting. He stares you in the face whilst being impaled on the hook, and your true angler is considerably annoyed that during such necessary operation he cannot obey old Izaak Walton's injunction to "use your live bait as if you loved him," for the goorgoora is furnished with a pair of horny nippers which, in his agony, he never fails to impress severely on the cuticle of his "biped tormentor." So the poor fellow is generally "whistled down the wind" as quickly as possible. I have seldom used the animal, but, to quote Izaak again, he is "a very choice bait," and I have seen very fine trout taken with him.'

'The only peculiarity observable in our favourite fish, the trout, as compared with the species in Europe, is the black spot instead of the crimson and yellow, and its only singularity is the truly "oriental taste" he shows in preferring such artificial flies as display the most gaudy and glittering colours. He is most successfully allured by a fly of tasteful compound, exhibiting a variety of crimson and yellow, purple and gold; in short, by using feathers of every hue radiant and glowing, such as the birds of this land of caloric, "with wings like their own sky," offer for our selection. Our Neemuch Izaak (a staunch, enduring, and steady angler) and myself have taken in one day, with the artificial fly, sixteen dozen of fine trout, besides several mahseer of two and three pounds each, which fancied the gaudy fabric.'

7 Hayman's Green,
W. Derby, Liverpool, F. V. EVANS
May 31, 1926.

[As the flies described above would in all likelihood not be procurable in India, Mr. Evans has very kindly got them made and mounted on gut traces by Messrs. Albert Smith & Co., Ltd., of Redditch, England. He has sent us out a small stock of these flies, which are similar or nearly similar to those used successfully in 1831 so that members wishing to make a test of the fishing in or around the localities mentioned in the note may be able to obtain their sets of flies from us free of charge. Eds.]

No. XXV.—DEATH FROM THE STING OF A SCORPION

On the evening of June 18, 1926 a boy named Bhaiyaram, son of Bihari Barbar of village Lata (Drug District, C.P.) aged 6 years was playing with some other boys outside the village under the Babul trees. At about 6 p.m. the boy was stung by a scorpion on his left foot. Maniram Kurmi who was working nearby heard the boy's cry and searched for the scorpion which he found and killed. It was of greyish colour. Fruitless attempts were made by the Busti people to cure the boy by Mantars.

The boy lost his senses at about midnight and expired at noon on June 19, 1926. At the time of inquest held by the Sub-Inspector of Police, on June 20, 1926, some watery discharge was coming out of the nose. The finger nails had turned blue and the body had become black.

Drug, G. S. SHUKLA, l. m. & s.,
July 17, 1926. *Offg. Civil Surgeon.*

[The effects of scorpion poison are seldom fatal to man though death has been known to follow in the case of victims in a poor state of health at the time of being stung. Another great factor to be reckoned with is Fright which in the case of snakes has been known to kill many persons bitten by perfectly harmless species. Eds.]

PROCEEDINGS

Proceedings of the Meeting held on September 1, 1926.

A meeting of the members of the Bombay Natural History Society and their friends was held on Wednesday, September 1, at 6.45 p.m. in the Rooms of the Natural History Section, Prince of Wales' Museum; Mr. G. F. J. Cumberlege, D.S.O., M.C., presiding.

WHITE TIGER

In the absence of Sir Reginald Spence owing to indisposition, the Honorary Treasurer drew the attention of those present to the skin of a White Tiger shot and presented to the Society by His Highness the Maharaja of Rewa. Some years ago there was published in the Journal an article entitled 'A White Tiger in Captivity' (vol. xxvii, p. 932). The specimen referred to in that article was caught in the same State near Sohagpur in December, 1915, and died recently in the Maharaja's gardens at Rewa.

White Tigers have been known to occur in Rewa State for a considerable length of time and it is known that there are one or two families of these animals living in the forests there to-day.

It is curious that albinism, though not uncommon among wild animals of different groups, should be seemingly restricted to this particular area with tigers, though white tigers have sporadically been seen in various parts of the country.

BACTERIOPHAGE FOR DYSENTERY AND CHOLERA

Major J. Morison, I.M.S., of the Haffkine Institute then gave a short account of the Bacteriophage for Dysentery and Cholera recently discovered by a French-Canadian Dr. D'Herelle.

He exhibited two tubes containing agar jelly, on the surface of which was a film produced by the growth of cholera vibrios. In this film were clear circular spaces as if the film had been pricked through with a pin. In these spaces no cholera vibrios could be found. The spaces were colonies of d'Herelle's 'bacteriophage'—literally 'eater up of bacteria'—a minute parasite of bacteria. Though the colonies were easily visible, the bacteriophage itself passed through a porcelain filter and was about one-tenth the size of the smallest organism visible under the highest powers of the microscope.

Dr. F. d'Herelle first discovered the bacteriophage in studying a bacterial disease of locusts in Mexico in 1909, but not till 1916 when he found this minute parasite in a man recovering from severe bacillary dysentery did he recognize the nature of the phenomenon shown in the exhibit. Since that time races of bacteriophage have been found which are more or less active against various other microbes: staphylococci which produce boils, the typhoid and paratyphoid bacilli, the plague bacillus, the vitrio fowl cholera, the bacillus of the septicaemia of buffaloes, etc. The latest to be discovered by Dr. d'Herelle himself when recently in Bombay is the cholera bacteriophage, and those were his first preparations.

The discovery of the bacteriophage opened a new chapter in the history of our knowledge of immunity to disease. In certain cases of dysentery, d'Herelle has been able to trace a struggle between bacilli, the more active the bacteriophage the more the patient improved. If the bacteriophage disappeared while the disease was still active, the patient's condition got worse. How far d'Herelle's discoveries may be applicable to the treatment of disease depends apparently on whether bacteriophages sufficiently strong can be discovered. A weak bacteriophage allows the bacillus to become immune against attack. A strong bacteriophage completely destroys the bacillus for which it is virulent.

MR. LAPERSONNE'S PAPER

Mr. Gill then read a very interesting paper by Mr. V. S. LaPersonne, the Society's collector, on a 'Collecting Trip to Ladak' which was illustrated by the author with lantern pictures.

The trip was organized by Col. Meinertzhagen for the purpose of acquiring a thorough knowledge of the resident species of birds found in Ladak and also of those which go up there to breed.

The route chosen was that which leads over the Great Himalayas at the depression known as the Zogi-la Pass, along the Indus Valley to Leh, the capital of Ladak, and thence on to the Chinese-Tibetan border, or that bleak region known as Chang-Chen-Mo Valley, the haunt of the wild yak, snow leopard and Tibetan gazelle. The mountain system of Ladak is punctuated by large salt lakes, which occur at 14,500 feet. A large proportion of the wild fowl that visit India in the winter breed on these lakes. Some of these lakes are 40 to 60 miles in length and 5 to 10 miles in breadth.

Winter conditions prevailed at altitudes over 14,500 feet throughout the year. This altitude appears to have no effect on human respiration. Tibetans live at these heights during summer only. The Expedition kept at elevations between 14,000 feet—10,000 feet for over four months. The party were physically weakened during their stay at these altitudes, the leader of the Expedition losing 28 lbs. in weight, and the author—his enthusiasm for mountain sublimity.

NEW MEMBERS

The following 35 new members were elected since the last meeting:—Mr. J. A. R. Gentle, Betul, C. P.; Mr. B. L. Glass, Nagpur, C. P.; H. H. Maharana Shri Sir Daulatsingjee, K.C.I.E., Thakur Saheb, Limbdi State, Limbdi; H. H. Raja Rawat Sir Birendra Singh, K.C.I.E., Ruler Rajgarh State, Rajgarh; His Excellency Sir John Kerr, K.C.S.I., K.C.I.E., Governor of Assam; Mr. J. L. H. Williams, South India; Mr. L. B. Holland, I.F.S., Rawalpindi; Mr. C. A. Malcolm, I.F.S., Nagpur, C.P.; Capt. H. A. Stevenson, I.A., Silchar, Assam; Shrimant Sankarrao Parasuramrao *alias* Appasaheb Patwardhan, Chief of Jamkhandi; Mr. R. N. Burton, Gauhati; Mr. F. Kindersley, I.C.S., Karwar; Mr. J. S. Brown, Bombay; Mr. B. C. A. Lawther, Peshawar; Mr. H. A. Ragg, Munnar, S.I.; H. B. Wood, Esq., Fort Sandeman; Mr. A. N. Barker, I.F.S., Rangoon; Mr. J. F. D. LaTouche, I.F.S., Rangoon; Mr. C. W. D. Kermode, I.F.S., Rangoon; Mr. G. Peddie, Secunderabad; Mr. E. J. Van Ingen, Ootacamund; Mr. H. V. Prendergast, Cawnpore; Capt. O. S. Cumming, B.A., Jhansi; Mr. W. S. Wood, Tavoy; H. H. Maharaja Gulab Singh Bahadur, Rew State, Rewa; Mr. R. W. Palgrave, Calcutta; Mr. A. F. R. Brown, I.F.S., Pakokku; Mr. A. B. Rayner, Lahore; Mr. J. Macpherson, Amritsar; The Mess Secretary, 1/12th F. F. Regiment, Jhansi, U.P.; The Mess Secretary, Officers' Mess, 1/10th Gurkha Rifles, Fort Sandeman; The Secretary, United Service Club, Ltd., Simla; the Hon'ble the Chief Commissioner, North West Frontier Province, Peshawar; Mr. Hugh D. Latham, Vellore; Mr. F. W. Gordon, I.F.S., Rangoon.

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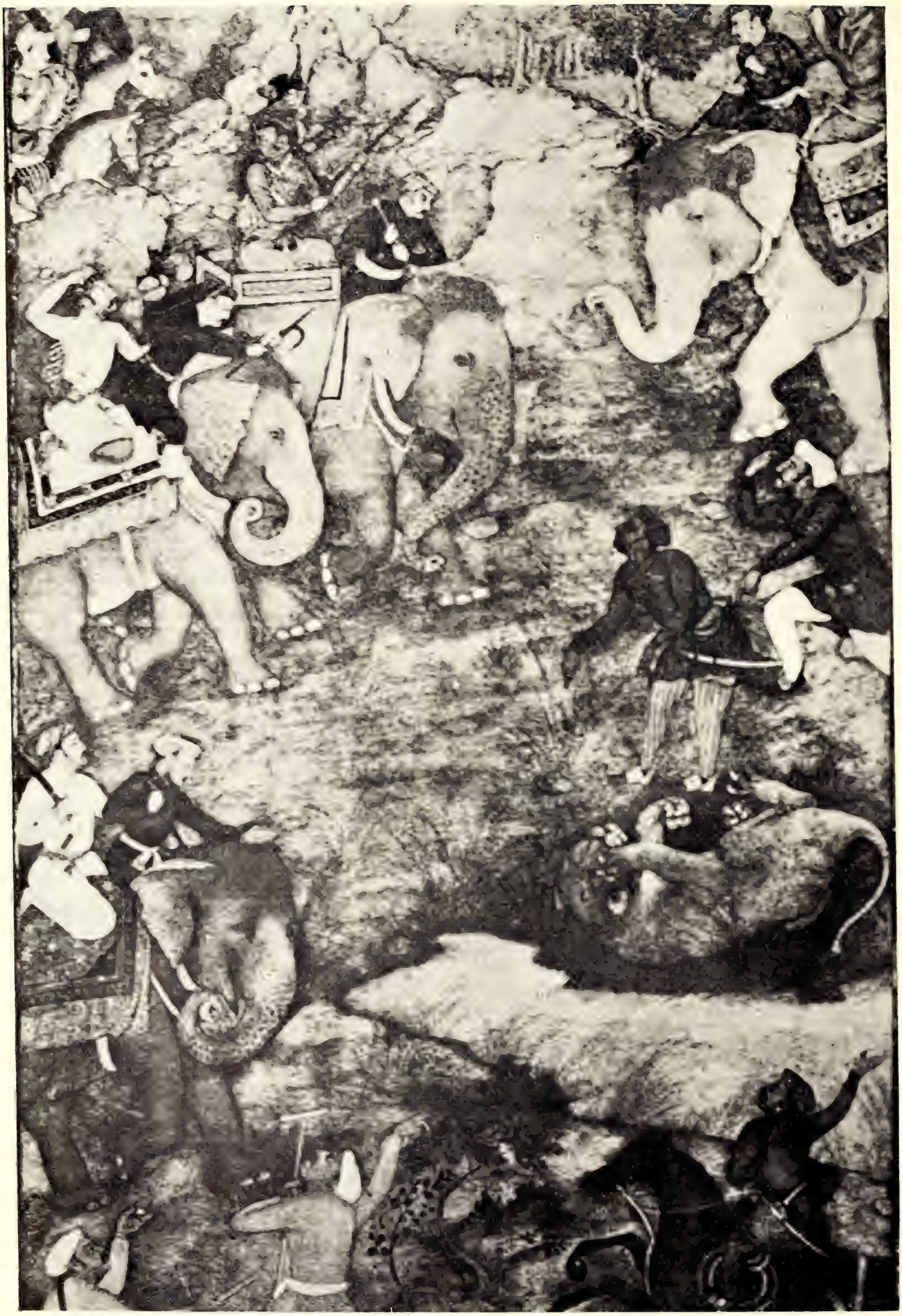

THE EMPEROR JEHANGIR SHOOTS A LARGE LION. (*Memoirs*, vol. ii, p. 284).
Painted *c.* A.D. 1623, Indian Museum, Calcutta, No. 316, size 12¼″ × 7¼″.
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THE MOGHUL EMPERORS OF INDIA AS NATURALISTS AND SPORTSMEN

BY

SALIM A. ALI

PART I

(*With 3 plates*)

The title of this paper is somewhat misleading, hence it may be advisable at the outset to indicate its scope. The term 'Moghul Emperors' here represents only the Big Six, from Babur—the illustrious founder of the dynasty—to Aurangzebe, with whose death the great empire launched on a career of steady and rapid decline.

The 'Naturalists' of the title also needs qualification. It stands here only in respect of animal life, though it is well known that the Moghuls were great lovers of Nature in all its other aspects as well.

The wonderful gardens[1] built by them all over Northern India remain to this day to bear testimony to their love for flowers and trees, and the genuine delight which Babur and his great-grandson Jehangir felt in the natural objects they saw around them cannot help impressing anyone who wades through the inimitable memoirs left us by these two sovereigns.

To avoid repitition of lengthy titles of works which I have most frequently quoted, I propose to use the following abbreviations :—

Babur = *Memoirs of Zahiruddin Mohomed Babur*, translated from the Chagatai Turki by John Leyden, M.D. and William Erskine in two volumes, annotated and revised by Sir Lucas King, C.S.I., LL.D., F.S.A.

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[1] For descriptions of the gardens see C. M. Villiers, *The Gardens of the Great Moguls*.

Jeh. = *Tūzūk-e-Jehāngiri* or *Memoirs of Jehangir*, written by the Emperor himself and translated in two volumes from the Persian by Alexander Rogers, I.C.S. (Retd.) and H. Beveridge, I.C.S. (Retd.)

Ain. = *Ain-e-Akbari* by Abul Fazl, translated by Blochmann (first volume) and Jarrett (second and third volumes).

Names of other works quoted from occur in full in the text.

Though it is not my purpose to go into the history of the rise and fall of this great house, the following few remarks concerning each of the six sovereigns may not be out of place for introducing my subject.

BABUR

Babur was a born commander and leader of men, possessing all the attributes that go to make a successful general, conqueror and administrator, and withal a very loveable and extremely human man.

He was an athlete of the highest order and a sportsman in every sense of the word. His nature was aesthetic to a degree, and all throughout the delightful memoirs written by himself, one constantly alights on passages which reveal something of the passionate infatuation he felt for the beautiful and the new, whether in scenery or architecture, plants, flowers or animals.

One of Babur's first cares after his victory at Panipat in A.D. 1526 was to describe at length the land of his acquisition, its peoples, customs, animals, fruits and flowers: to compile in fact a comprehensive Gazetteer of Hindustan. The outstanding feature of his accounts is their extreme truthfulness and accuracy. If there is anything of which he is not positive at the time of writing, he does not omit to make special mention of the fact, and hearsay of the veracity of which he is not convinced is likewise duly recorded as such. For instance, writing about parrots he says: 'I had imagined that a parrot or sharak (Myna) only repeated what it had been taught, and could reduce nothing into words from its own reflections. Abul Kasim Jalair who is one of my most familiar servants lately told me a remarkable incident. A cage of a parrot of this last-mentioned species [1] having been covered up, the parrot called out, "Uncover my face, I cannot breathe." On another occasion the bearers who were employed to carry it had set it down to rest themselves and a number of people passed by, the parrot called out, 'Everybody is going by, why don't you go on?" Let the credit rest with the relater! Yet till one hears such things with his own ears he never can believe them.'

Similarly in another place after describing the 'Lujeh' (Monal Pheasant) he says with the keenest humour: 'A remarkable circumstance is told of them. It is said that in winter they come down to the skirts of the hills and if in their flight one of them happens to pass over a vineyard, he can no longer fly and is taken. God knows the truth! Its flesh is very savoury.'

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[1] The Large Indian Paroquet (*Paleornis nepalensis*).

Whether engaged in weighty affairs of state, or in marching against a foe, Babur always had his senses wide awake to objects around him beyond the pale of his immediate concern. A new flower or bird or beast never failed to excite in him a feeling of the profoundest interest. He made a careful mental note of the object, and reproduced it faithfully in his memoirs whenever he found a temporary respite from the arduous duties of kingship in a newly conquered and unsettled country. For example, the Pied Myna (*Sturnopastor contra*) finds a place in his memoirs thus: 'When I threw a bridge over the Ganges and crossed it, driving the enemy before me, I saw in Lucknow, Oudh and these countries, a species of Sharak which has a white breast and a piebald head with a black back. I had never seen it before. This species probably does not learn to speak at all.'

Of the larger mammals of Hindustan, the rhinoceros was one that must have seemed altogether strange and unnatural to the conquerors, and Babur took great delight in hunting the beast. In his memoirs he gives the following account of a hunt. (This was at the time of his final march against Hindustan which ended successfully at Panipat):—

'We continued our march till we came near Bekram (Peshawar) and then halted. Next morning we continued halting in the same station, and I went out to hunt the Rhinoceros. We crossed the Siāh-āb (i.e. Black River—perhaps another name for the Bara) in front of Bekram, and formed our ring lower down the river. When we had gone a short way, a man came after us with notice that a rhinoceros had entered a little wood near Bekram and that they had surrounded the wood and were waiting for us. We immediately proceeded towards the wood at full gallop and cast a ring round it. Instantly on our raising the shout the rhinoceros issued out into the plain. Humayun and those who had come from the same quarter (i.e. from Turkestan) never having seen a rhinoceros before, were greatly amused. They followed it for nearly a kos, shot many arrows at it and finally brought it down. The rhinoceros did not make a good set at any person or any horse. They afterwards killed another rhinoceros. I had often amused myself by conjecturing how an elephant and rhinoceros would behave if brought to face each other; on this occasion the elephant-keepers brought out the elephants so that one elephant fell right in with the rhinoceros. As soon as the drivers put their beasts in motion, the rhinoceros would not come up but immediately ran off in another direction.' [1]

Further on Babur mentions, 'In the course of my expeditions into Hindustan, in the jungles of Peshawar and Hashnagar I frequently killed the rhinoceros. It strikes powerfully with its horn, with which in the course of these hunts, many men and horses were gored. In one hunt it tossed with its horn a full spear's length, a young man named Maksud, whence he got the name of " Rhinoceros Maksud " (i.e. Rhino's aim).'

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[1] Captain Williamson in his *Oriental Field Sports* recounts several incidents of the deadly enmity that is supposed to exist between the rhinoceros and the elephant and the stories copied from this not over-veracious source have subsequently found their way into European works on Natural History. Despite its bulk and strength the rhino is as a rule quiet and inoffensive. Owing to the nature of the terrain they inhabit, elephants are almost always used in rhino hunting in India. As a rule the mounts remain indifferent in the presence of the enemy though occasionally one takes fright and bolts.

On the conclusion of Babur's accounts of the Fauna of Hindustan, descriptions of the trees, flowers, and fruits follow, and throughout is noticeable the under-current of his superlatively aesthetic soul, and the knowledge and insight born of careful and intelligent observation. It appears truly remarkable that a man in Babur's situation, faced with innumerable and ever-recurring practical and administrative difficulties in a foreign an unsettled land, with the prospect of rebellion within and invasion without perpetually staring him in the face—with marked discontent amongst his troops and following to boot—should have found time to devote himself so earnestly to minor pleasures which would probably have had no appeal for lesser natures than his own.

HUMAYUN

On the death of Babur, his son Humayun ascended the throne of Hindustan. Unfortunately he appears to have kept no memoirs of himself and the chief contemporary records availabe to us are the *Tazkereh-alvākeaat*[1] (or private memoirs of the Emperor Humayun) written by his confidential domestic Jouhar, and the delightful *Humāyūn Nāmā*[2] of his sister Gulbadan Banu Begum.

These tell us extremely little of the aspect of Humayun's nature that concerns our paper, but however suffice to establish the fact that he had inherited in full measure his father's love of nature and fondness for sport.

That our information as regards Humayun's private life and affairs should be so scanty is not surprising ; for throughout his reign he was being unremittingly harassed by his rebellious brothers, and it was not long after his accession that he was even driven out from his kingdom and was not able to return and regain it till three or four years later.

No elaborate accounts of Humayun's hunts are available. That he showed keen partiality for and considerable skill in the chase, however, may be gleaned from several references in the memoirs of his father. With paternal joy and pride we are told how on one occasion when the prince was eleven years of age, and Babur and several of his associates were in a boat in the ' Bāgh-ē-banafshēh ' (Garden of Violets) in Kabul, Humayun ' shot a waterfowl in very handsome style.'[3]

Further on is recounted[4] how the sight of a rhinoceros—an animal Humayun had never seen before—at Peshawar had amused him and with what enthusiasm he and his party had followed the beast and brought it down and then had killed another. Hunting an animal like the rhino with bows and arrows, which were the weapons employed on this occasion, is a feat that calls for not only skill and physical strength but an uncommon amount of that dash and courage which were ever characteristic of the great Moghuls. And this was at a time when the prince was barely seventeen years of age.

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[1] Translated from the Persian by Major Charles Stewart of the Hon. East India Company's Service.

[2] Translated by Mrs. Annette S. Beveridge.

[3] *Babur*, vol. ii, p. 138.

[4] *Ibid.*, p. 159.

That Humayun was naturalist at heart is evident from just this one little passage that appears in the *Tazkereh.* To realize the true significance of the incident it must be remembered that it happened at a time when defeated by Sher Shah and deprived of his kingdom, he was fleeing for his life and liberty through the inhospitable desert of Sind—a harassed refugee—subjected to the greatest hardships from hunger and thirst, and accompanied only by a mere handful of his faithful adherents. At Amerkote, ' . . . the king undressed and ordered his clothes to be washed, and in the meantime wore his dressing gown. While thus sitting, a beautiful bird flew into the tent the doors of which were immediately closed and the bird caught. His Majesty then took a pair of scissors and cut some of the feathers off the animal ; he then sent for a painter and had a picture taken of the bird and afterwards ordered it to be released.'

A temperament capable of being roused from the gravest anxiety and concern to light-hearted pleasure and interest at the mere sight of a strange and insignificant bird, surely proves a more than ordinarily deep-rooted love for Nature. In spite of the fact that Humayun's reign was short and replete with trouble and anxiety, he sometimes found leisure for indulging in the chase, for which sport as a care-free prince we know he had evinced marked predilection. His sister tells us [1] that one day at Kabul, ' His Majesty attended by Mirza Hindal (his brother) was hunting near the mountain passes. They had very good sport. The Emperor went to where the Mirza was hunting and had made a very good bag. Following the rules of Chingiz Khan the Mirza proffered his game to the Emperor, for it is the rule of Chingiz Khan that inferiors should so act towards their superiors. In short he gave the Emperor all his game. . . . '

This account also serves in bringing to light the peculiar hunting etiquette of the Moghuls, traces of which are to be met in our own day especially in relation to the hunts of Rajas, Nawabs, and other high personages.

It is much to be regretted that Humayun's career as a Naturalist was so disturbed and short. He was a devout lover of Nature, and given the opportunity, we should certainly have expected to be left with notes and descriptions at least equalling in originality and interest those of his father or of his grandson Jehangir.

AKBAR

Akbar, rightly called 'the Great' reigned over Hindustan from 1556 to 1605. Summing up his character Dr. Richard von Garbe[2] states: 'Akbar was very fond of flowers and perfumes and especially enjoyed blooded doves (pigeons) whose care he well understood. About 20,000 of these peaceful birds are said to have made their homes in the battlements of his palace.' His historian (Abul Fazl) relates, 'His Majesty deigned to improve them in a marvellous manner by crossing the races which had not been done formerly.'

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[1] *Humāyūn Nāmā*, Beveridge, pp. 96–97.

[2] *Akbar, Emperor of India,* a Picture of Life and Customs from the sixteenth century.

'Akbar was passionately fond of hunting and pursued the noble sport in its different forms, especially the tiger hunt and the trapping of wild elephants, but he also hunted with trained falcons, and leopards. He was not fond of *battue*; he enjoyed the excitement and exertion of the actual hunt as a means of exercise and recreation for training the eye and quickening the blood. Besides chess, cards and other games, fights between animals may be specially mentioned, of which elephant fights were the most common but there were also contests between camels, buffaloes, cocks and even frogs, sparrows and spiders.'

In support of his conclusion that Akbar was, true to the traditions of his ancestry, a brave man, von Garbe quotes the following incident:—'On the way back to Agra where at the time he was holding court, Akbar had ridden alone in advance of his escort and suddenly found himself face to face with a powerful tigress who with her five cubs came out of the shrubbery across his path. His approaching attendants found the nineteen-year old emperor standing quietly by the side of the slaughtered beast whom he had struck to the ground with a single blow of his sword. To how much bodily strength, intrepidity, cold-blooded courage and sure sightedness this blow of the sword testified which dared not come the fraction of a second too late, may be judged by any one who has any conception of the spring of a raging tigress anxious for the welfare of her young.'

Two other incidents are recorded[1] where the Emperor saved the life of a man who was in the act of being mauled by a tiger by shooting the animal dead when his following were in a state of panic and complete disintegration, and incapable of coming to the victims' assistance. Other equally outstanding examples of his cool headed courage and daring are not wanting, and some of Abul Fazl's descriptions of the fights of infuriated and 'musth' elephants, one of them being ridden and guided by the young Akbar, though couched in such flowery and ornate style as to render the incidents somewhat melodramatic, are sufficient to convince the most exacting of his wonderful prowess, pluck and bravery.

Akbar was passionately fond of animals, and the Royal Menagerie was a very extensive one comprising of, as Abul Fazl states, 'Animals of all kinds from Persia, Turkestan and Kashmir, whether game or other' which had been brought together 'to the wonderment of beholders.' Bernier[2] mentions that the inmates of this menagerie were led past under the royal window where the monarch sat every day about noon, the procession commencing with the horses and elephants. 'Other animals are next introduced' continues the writer, 'tame antelopes kept for the purpose of fighting with each other;[1] Nilgaux or grey oxen that appear to me to be a species of elk; rhinoceroses; large Bengal buffaloes with prodigious horns that enable them to contend against lions and tigers; tame leopards or panthers employed in hunting antelopes; some of the fine sporting dogs from Usbec of every kind, and each dog with a small red covering; lastly every species of birds of prey used in field sports for catching partridges, cranes, hares and even it is said, for hunting antelopes on which they pounce with violence beating their heads and blinding them with their wings and claws.'

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[1] *Ain.*, vol. i, p. 284.

[2] Francois Bernier, *Travels in the Mogul Empire, A.D. 1656–1668* (A. Constable).

Abul Fazl informs us that Akbar paid great attention to the selection and breeding of elephants, camels, cows, mules and horses and that through his encouragement of the last, the breed of horses produced in Hindustan was as fine as those of Irak or Arabia.

One of the modes of hunting most frequently employed by the Moghul emperors was the *Qamargah* or 'Ringing-in' method. Last tracts of country were surrounded by the armies which gradually worked their way towards the centre driving in and collecting the game. On account of the area over which operations extended, very often hundreds of square miles, the processes occupied several months. The various divisions of the army were placed under command of their proper officers, and the whole thing was really in the nature of what are now known as Army Manœuvres. As the favourite plan of campaign of the Moghuls was to surround an enemy first and then gradually close in upon him, these *Qamargah* hunts provided the means of keeping the soldiery in the necessary training and practice in times of peace.

One such 'drive' that took place under orders of the Emperor Akbar in the year 1567 is remarkable for the magnitude of the scale on which operations were carried out. On this occasion 50,000 beaters were employed and, according to Abul Fazl involved all the country 'from near the mountains on the one side and from the River Bihat (Jhelum) on the other.' The historian proceeds: 'Each district was made over to one of the great officers and Bakhshis, Tawacis and Sazawals were appointed to every quarter. Several thousand footmen from the towns and villages of Lahore Province were appointed to drive the game. A wide space within ten miles of Lahore was chosen for the collecting of the animals.'

This drive occupied a whole month. When all the arrangements were completed, 'His Majesty the Shah (Akbar) went to the hunting ground and viewed it from the circumference to the centre. Every one of the Grandees and other servants who had exerted themselves in this delightful service was gratified by H.M's approbation. Then he placed the foot of dominion in the stirrup of auspiciousness and made his tiger-like steed career in pursuit of the prancing deer. He used the arrow, the sword, the lance and the musket. At the beginning the hunting ground was ten miles in circumference, but day by day the *Qamargah* was pushed on and its area lessened. . . . '

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[1] The Emperor Akbar was particularly fond of this sport and in the *Ain.* pp. 218–22 are to be found full details regarding the kinds of fighting deer, how they fought together, and elaborate regulations as to the betting allowed on such encounters.

Akbar had a special Game Department and caused an account to be kept of all the animals hunted with measurements and the minutest details concerning them. Particulars of the guns or other weapons used upon different occasions were also recorded. He knew his favourite guns by names and was especially fond of one which he called ' Sangram ' and which afterwards came into the possession of his son Jehangir who likewise prized it highly. Akbar was a remarkable shot with this piece, and Jehangir states in his *Memoirs*, ' He (Akbar) had no rival in shooting with a gun, and with the one with which he killed Jitmall (the defender of Chitor), and which he called "Sangram" he killed some 3,000 or 4,000 birds and beasts.' Abul Fazl is more moderate; he says[1] that Akbar killed 1,019 animals with ' Sangram '.

Besides shooting with the gun Akbar also did a good deal of hunting with the bow and arrow, and several instances are on record of his tackling tigers with these weapons.

He was possessed of remarkable observational powers and it is said of him that he could at once tell by seeing the hide, to what hunting ground a particular deer belonged.[2]

Besides the cheetas (it is asserted to the number of 9,000) and lynxes which largely constituted his hunting establishment, Akbar was extremely fond of good hunting dogs, and imported them from all countries. ' Excellent hunting dogs come from Kabul,' says Abul Fazl, ' especially from the Hazara District (north of Rawalpindi). These dogs will attack every kind of animals, and more remarkable still, they will attack a tiger.'

European bloodhounds were also imported by the Portuguese, which helped them greatly to maintain favour at court.

With regard to the birds employed in the chase, the historian says, ' H.M. is very fond of these remarkable animals and often uses them for hunting purposes. Though he trains the Bāz (*Astur palumbarius*), Shāhin (*Falco peregrinator*), Shunqar (either *Falco cherrug* or *F. milvipes*) and Burqat falcons (probably the Golden Eagle—*Aquila chrysaëtus*) and makes them perform wonderful deeds, H.M. prefers the Bashāh (Sparrow Hawk—*Accipiter nisus*), to which class of hawks he gives various names.'

Among the various birds trained for the chase are mentioned the crow, sparrow and quail (?). *Odhpapars* which were brought from Kashmir, appear from the description to be some species of Kingfisher. They are described as of a blue or green colour (sabz) smaller than a parrot; with a red beak straight and long; and a tail rather elongated. They were taught to bring down small birds and return to the hand of their keepers.

JEHANGIR, 1605–1627

If Akbar was the greatest monarch of the Moghul dynasty, it cannot be denied that Jehangir was far and away its greatest naturalist. His profuse and engrossing memoirs are a veritable natural history of the animals that came under his notice, and a record of the most searching observations concerning them.

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[1] *Ain*, vol. i, p. 116.

Ibid., p. 290.

It has been rightly said of Jehangir that had he been head of a Natural History Museum he would have been a better and happier man. Besides a passion for justice the outstanding features of his character were his love of nature and his powers of observation.

Jehangir's love of the chase was excessive. He never failed to create opportunities for indulging this propensity and as a marksman showed considerable skill. He writes of himself, 'I am myself not without some skill in the use of this weapon (meaning the famous "Sangram" also called "Droostandaz" =" Straight thrower") being exceedingly fond of field sports of every kind and having frequently with the same piece killed twenty antelope of a day.' He was an adept at the use of the bow and arrow, and often used these weapons especially in *Qumargah* hunts.

Extensive game preserves were maintained and frequently the emperor hunted accompanied by the ladies of his zenana. His beautiful and accomplished queen Nur Jehan was his constant companion on such occasions. She was an excellent horsewoman and possessed remarkable dexterity in handling a gun. Jehangir gives the following account of a hunt where Nur Jehan killed four tigers in quick succession. ' . . . the huntsmen marked down four tigers and I went out to hunt them with my ladies. When the tigers came in sight Nur Jehan Begum submitted that if I would order her she herself would kill the tigers with her gun. I said "Let it be so." She shot two tigers with one shot each and knocked over the two others with four shots. In the twinkling of an eye she deprived of life the bodies of these four tigers. Until now such shooting was never seen that from the top of an elephant and inside of a howdah, six shots should be made and not one miss, so that the four beasts found no opportunity to spring or move. As a reward for this good shooting I gave her a pair of bracelets of diamonds worth one hundred thousand rupees and scattered 1,000 *ashrafis* (gold mohurs) over her.'

It is unnecessary here to dilate upon Jehangir's qualities as a naturalist. His descriptions of animals that I have quoted in the following pages bespeak his interest and proficiency in unmistakable language.

Like his father, Jehangir also caused minute records to be kept of his hunts with particulars as to the bag, etc. The registers showed that from the twelfth year (1580) of his age to his fiftieth lunar or forty-eighth solar year, 28,532 animals had been taken in his presence, including 17,167 which had been killed by the Emperor himself. These are tabulated thus:—

Tigers (and lions)	86
Bears, leopards, foxes, otters (ubdilao) and hyænas	9
Blue bulls	889
Mhaka[1]	35

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[1] It has been suggested that this may be the 'Maha' or Swamp Deer of the Terai. As there is no mention of Sambur elsewhere in the list, it is possible these were included here. Jehangir mentions that in size this animal was equal to the Nilgai.

Black buck, chinkara, cheetal, mountain goats, etc.	1,670
Rams (quj) and red deer	215
Wolves[1]	64
Wild buffaloes	36
Pigs	90
Rang (ibex)	26
Mountain sheep	22
Arghali	32
Wild asses	6
Hares	23
Total	3,203

Of the 13,954 birds that constituted the total bag during the period were :—

Pigeons	10,348
Lagai-jhagar (a species of hawk)	3
Eagles	2
Qaliwaj (kites)	23
Owls (chugd)	39
Qautan (goldfinch ?)	12
Mush-khwar = ‘ rat eaters ’ (probably harriers, etc.	5
Sparrows	41
Doves	25
Owls (bum)	30
Ducks, geese, cranes and wildfowl	150
Crows	3,276
Total	13,954

Crocodiles	10

Jehangir also was exceedingly fond of good hunting dogs, and collected them from distant parts. Sir Thomas Roe records that once the Emperor mentioned to him ‘ I only desire you to help me to a horse of the greatest size, and a male and female of mastiffes and the tall Irish Greyhounds and such other dogges as hunt in your lands.’

Long accounts appear in the *Memoirs* of the various hunting exploits of the Emperor which are too profuse to reproduce here. A number, however, will be found under descriptions of the animals to which they relate.

SHAH JEHAN

Shah Jehan ruled over the Moghul Empire from 1627 to 1665. Gifted with the love of nature and artistic temperament of his

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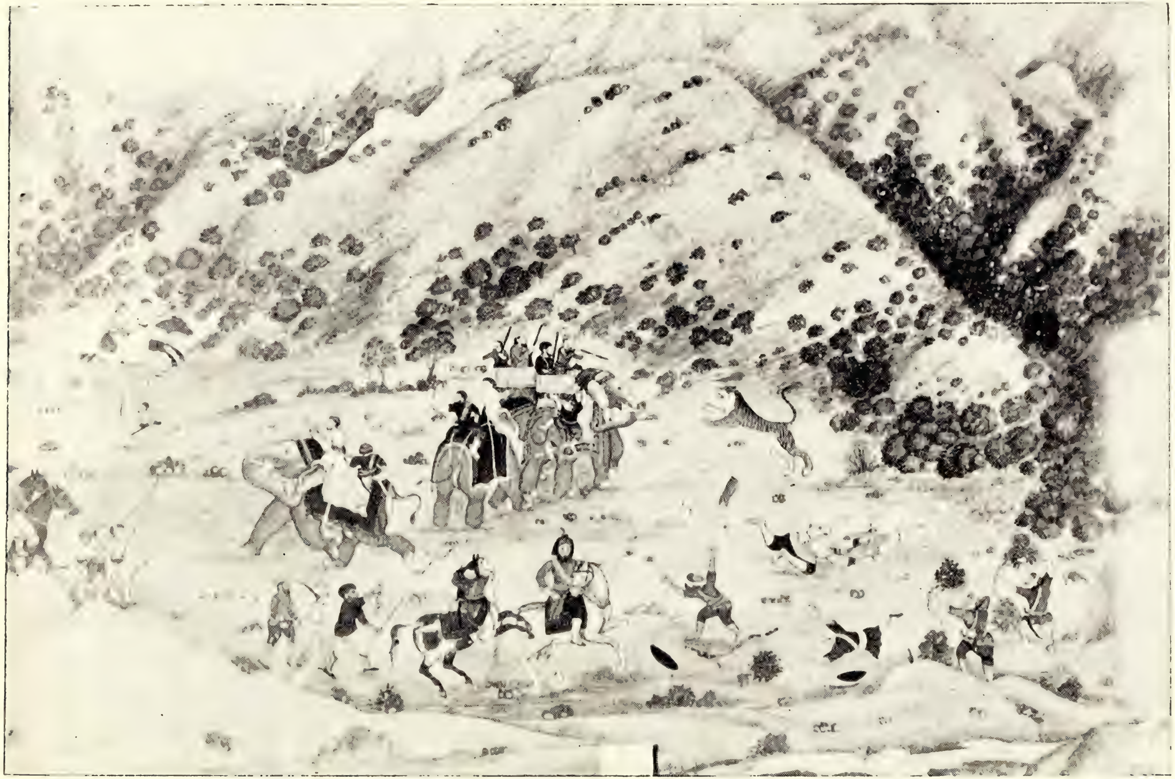
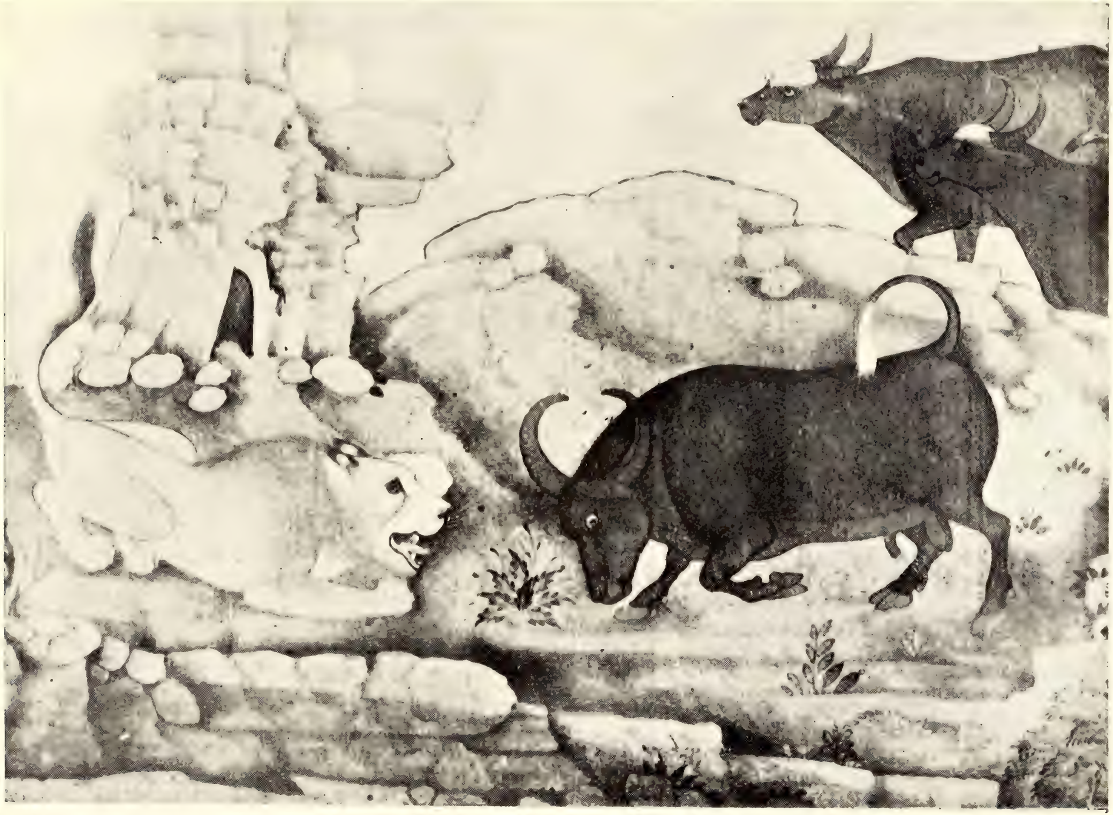
[1] In Persian ‘ Kūrg ’ is a rhinoceros and ‘ Gūrg ’ = wolf. I think it very probable that if it is not ‘ kūrg ’ in the original MS there is at least some confusion on this point. Jehangir records the killing of a rhino (cf. Rhinoceros) with a single shot in the temple, and this does not appear in the above list of game.



THE CLOSE OF A QAMARGAH HUNT

From a Moghul painting in the Prince of Wales Museum, Bombay



A LION HUNT WITH BUFFALOES
From a Moghul Painting in the Prince of Wales Museum, Bombay

distinguished ancestors, his name is however best associated with architecture. The palace-fort at Delhi and the peerless Taj at Agra are living tributes to his magnificent regime.

Compared with his father, Shah Jehan's fondness for sport was moderate. He preferred hawking and hunting with cheetas to the actual shooting of game.

Jehangir relates that it was once reported to him while encamped in the neighbourhood of Ajmir that there was a man-eating tiger about who had already accounted for several lives. The Prince, Shah Jehan, was detailed to ' save the people from its wickedness ' and before nightfall the animal was shot and brought to the Emperor.

The following is an account of one of Shah Jehan's tiger hunts written by Manucci, who lived at his court for a number of years. ' His ordinary amusement,' says the writer,[1] ' was tiger hunting, for which he kept ferocious buffaloes with very big horns. These fought with each other or with tigers, and they are very brave animals, and skilful in the sport above referred to.

When the king desires to go out hunting the huntsmen are warned. These men see to the finding of the tigers and send out into the jungle asses, cows, sheep and goats to prevent the tigers from changing their haunts. The king goes out on his tallest elephant and the other princes likewise on elephants acquainted with the requirements of this sort of fight. They sit in uncovered howdahs, each one with his matchlock. Then they encircle the jungle with high nets, leaving only one opening, through which the king and huntsmen enter. Around the net on the outside stand a number of soldiers, who cannot wound the tiger when it comes near the net, nor can the tiger injure them, for in no manner can it break the net and get out. The order in which the king moves is as follows: In front go the buffaloes, sometimes more than one hundred in number, all in a row. On each one is mounted a man with his legs guarded by leather, and having a broad sword in one hand and holding with the other the reins, which are passed through the buffaloes' nostrils. Behind them comes the king on an elephant, and after the king the princes and the men in highest favour. When they get into the jungle where the tigers are, the buffaloes advance slowly in the formation of a half moon, until the tigers are in sight. After locating the tigers by sight and smell, a circle is formed, leaving them in the centre. In this way, the tigers finding themselves caught, search for an exit. Unable to get away, each one makes its spring in the direction that it sees best. When this spring takes place the man who is mounted on top jumps off with agility, and the buffaloes seize the tigers on their horns with great dexterity and, shaking their heads tear them to pieces. If any one of the tigers escapes the horns or refuses to stir from its place, the king fires his gun and kills it, or gives an order to kill it.

Sometimes they go out to these hunts without taking any buffaloes, but riding on elephants as I have before said. This way of hunting has much more risk for the hunters. Once it happened to King Shah Jehan that a badly wounded tiger bounded up and hung on with its claws fixed in the elephant's head. The elephant-driver fell to the ground from fright. The king seeing himself in this urgent danger, clubbed his matchlock and hit the tiger on the head with it, but the tiger did not let go, and the elephant finding he could not make use of his trunk, ran furiously till he found a tree, against which he crushed the tiger. It was on this account that Shah Jehan gave orders for the head of the elephants to be protected in future down to the end of the trunk with a covering of thick leather, studded with sharp nails. In addition to the huntsmen, there is always an official present whose business is to take possession of the tiger's whiskers ; and therefore as soon as the tiger is dead, they put on his head a leather bag, coming down as far as the neck. Having tied the bag the officer attaches to it his seal. After this the tiger is carried in front of the entrance to the royal tents, when the official appears who has charge of the poisons, and removes the whiskers which are employed as venom.'

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[1] *Storio do Mogor* or *Mogul India*, 1653–1708, by Niccolao Manucci, translated with introduction and notes by William Irvine, B.C.S. (Retd.), vol. i, p. 191.

Shah Jehan devised a novel method of punishing officials found guilty of taking bribes or of failing to discharge their duties to his subjects by getting them bitten by poisonous snakes in his presence in open court. The process has been described in detail under ' Snakes '.

AURANGZEBE, 1665–1707

The circumstances under which Aurangzebe came to the throne of Hindustan are well known and no doubt supply the basis for the character in which this Emperor has been painted by most historians of the past.

The recent researches of Dr. Jadunath Sarkar, however, have thrown new light upon this much misunderstood and misrepresented sovereign, and done much to vindicate his reputation. As far as concerns our paper, however, Aurangzebe's was not a very fruitful career. He was a man possessed of an indomitable will and courage, but appears on the whole to have taken life much more seriously than any of his forbears, and this left him little leisure for lighter pursuits.

He was fond of the chase and occasionally indulged in hunting with cheetahs and hawks. Hunting the lion was his favourite sport. The method of hunting most commonly in use at this periods also was the *Qamargah* as will be seen from the following account by Bernier,[1] who was physician at the Court for a number of years : ' I could never conceive how the Great Mogul could hunt with an army of one hundred thousand men, but there certainly is a sense in which he may be said to hunt with 200,000 or with any number of which his army may consist. In the neighbourhoods of Agra and Delhi, along the course of the Jumna reaching to the mountains, there is a large quantity of uncultivated land covered either with copsewood or with grasses six feet high. All this land is guarded with the utmost vigilance ; and excepting partridges and quails and hares, which the natives catch with nets, no person, be he who he may, is permitted to disturb the game which is consequently very abundant. Whenever the monarch is about to take the field, every game keeper near whose district the army is to pass is called upon to apprise the Grand Master of the hunt of the various sorts of game under his particular charge, and of the places where they are in the greatest plenty. Sentries are then stationed at the different roads of that district to guard the tract of ground selected, which extends sometimes four or five leagues ; and while the army is on its march, on one side or the other, so as to avoid that tract, the king enters it with as many Omrahs and other persons as have the liberty to do so, and enjoys leisurely and uninterruptedly the sports of the field, varying them according to the nature of the game.'

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[1] Francois Bernier, *Travels in the Mogul Empire, A.D 1656–1668* (A. Constable).

Bernier then goes on to describe the various methods of hunting, such as with cheetahs, tiger hunts and so on.

The order followed in the arrangement of the descriptions and notes concerning of the animals of Moghul Hindustan is that adopted in the Fauna of British India series.

THE BENGAL MONKEY. (*Macacus rhesus.*)

Babur writes about this species as follows ' One species (of monkey) is the smaller that is brought to our country. Its hair is yellow ; its face white ; its tail is not very long. The jugglers teach them tricks. It is met with in the hill country of Dāreh Noor on the Koh-e-Sufid on the outskirts of the hills in the neighbourhood of Khyber, and from thence downward throughout all Hindustan. It is not found in the places higher up than the places I have mentioned.'

THE LANGUR OR HANUMAN MONKEY. (*Semnopithecus entellus.*)

Babur says : ' There is another species of monkey which is not found in Bajour, Sawad and these districts, and is much larger than the kinds brought to our country. Its tail is very long ; its hair whitish ; its face entirely black. They call this species of monkey " Langur " and it is met with in the hills and woods of Hindustan.'

Jehangir remarks about the animal as follows : ' The Langur is an animal belonging to the monkey tribe. But the hair of the monkey (*maimun*—no doubt the Bengal Monkey) is yellowish and its face is red, while the hair of the Langur is white and its face is black. Its tail too is twice as along as the *maimun's*. Pahluwan Bahauddin, the musketeer, brought a young langur (at Dohad, on the borders of Malwa and Gujerat) with a goat, and represented that on the road one of the marksmen had seen the female langur with a young one in its arms on a tree. The cruel man had shot the mother, which on being struck had left the young one on a branch and had herself dropped on the ground and died. Pahluwan

Bahauddin had then come up and taken down the young one and put it beside a goat to be suckled. God had inspired the goat with affection for it and it began to lick the monkey and fondle it. In spite of difference of species, she showed such love as if it had come out of her own womb. I told them to separate them, but the goat immediately began to lament, and the young langur also became much distressed. The affection of the monkey is not so remarkable as it wanted to get milk, but the affection of the goat, for it was remarkable. I have written these things on account of their strangeness.'[1]

Jehangir records coming across this species of monkey at the village of Bakkar while on the march to Kashmir, in about the year 1620.[2]

OTHER SPECIES

Babur observes: 'There is still another species of monkey whose hair, face and limbs are quite black; they bring it from several islands of the sea.' This may be one of the Gibbons, *Hylobates* sp., possibly the White-handed Gibbon, *Hylobates lar*, which occurs throughout the Malay Peninsula and islands.

Abul Fazl describes as follows what from the indication of its size may have been an Orangutan. 'The "Ban-manus" is an animal like the baboon, dark in colour and in stature and face resembling a human being and walks on two feet. Although it has no tail, its body is slightly covered with hair. One of these was brought to His Majesty (Akbar) from Bengal which performed the most astonishing antics.' [3]

'Jal manus' or 'Ban manus' in Hindi literally means 'Jungle man,' and is the name by which the Orangutan is known in India.

LEMURS

Some species of Lemur is evidently referred to in the following description; Jehangir describes this as 'a monkey of a strange and wonderful form. Its hands, feet, ears and head are like those of a monkey and its face is like that of a fox. The colour of its eyes is like that of a hawk's eye, but the eyes are larger than those of a hawk. From its head to the end of its tail it is an ordinary cubit in length. It is lower than a monkey and taller than a fox. Its hair is like the wool of a sheep, and its colour like that of ashes. From the lobe of its ear to its chin it is red and of the colour of wine. Its tail is two or three fingers' breadths longer than half a cubit, quite different from that of other monkeys. The tail of this animal hangs down like the tail of a cat. Sometimes it makes a sound like a young antelope. On the whole it is a strange beast.' [4]

This was included among the animals brought back by his envoy from Goa, whence he had been authorized to purchase and bring 'for the private use of the Government' certain rarities procurable there, regardless of cost.

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[1] *Jehangir*, vol. i, p. 445.

[2] *Ibid.*, vol. ii, p. 130.

[3] *Ain*, vol. iii.

[4] *Jehangir*, vol. ii, p. 215, *et. seq.*

Writing at Agra, Jehangir mentions that ' A dervish from Ceylon came and brought a strange animal called "*deonak*" (or "*devang-devtaq*"). Its face was exactly like a large bat, and the whole shape was like that of a monkey, but it had no tail. Its movements were like those of the black tailless monkey which they call "Ban-manush" in the Hindi language. Its body was like that of a young monkey two or three months old. It had been with the dervish for five years. It appeared that the animal would never grow larger. Its food is milk and it also eats plantains. As the creature appeared very strange, I ordered the artists to take a likeness of it in various kinds of movements. It looked very ugly.' [1]

The identity of this animal as the Slender Loris, of which three species occur in South India and Ceylon, is unmistakable. According to Blanford, its Telugu name is *Devanga-pilli* and Tamil *Tevangu.*

THE LION

In his Fauna of Hindustan [2] Abul Fazl mentions the lion as being numerous.

Jehangir describes a lion hunt of his father, the Emperor Akbar, in a jungle in the neighbourhood of Lahore ' which was known to be infested by these fierce and ferocious quadrupeds to the number of twenty, male and female.'

Jehangir shot a lion while encamped at the village of Giri in the Subah of Malwa about which he remarks: ' As the braveness of the lion (*Shir babar*)[3] has been established, I wished to look at his intestines. After they were extracted it appeared that in a manner contrary to other animals, whose gall-bladder is outside their liver the gall-bladder of the lion is within its liver. It occurred to me that the courage of the lion may be from this cause.'[4]

The shooting of another lion is recorded by the same Emperor in the neighbourhood of Shakkar Tank (now locally called ' Sagan Sea' tank) within the famous fortress of Malwa on about March 25, 1617. On this occasion the lion charged his retinue and mauled ten or twelve persons, whereupon Jehangir ' finished his business with three shots from my gun, and removed his evil from the servants of God.'[5]

Another lion was shot by him in the neighbourhood of the pergana of Rahimabad (probably in the Bari Duab). This appears to have been a particularly large animal and Jehangir writes of it as follows: ' Of all the tigers (? lions) I have shot from the time I was a prince I never saw a tiger (?) like this for size and majesty, and the symmetry of its limbs. I ordered the artists to take its portrait according to its real form and body. He weighed 8½ Jehangiri maunds. His length from the top of his head to the end of his tail was 3½ cubits (?) and 2 tassu.'[1]

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[1] *Jehangir*, vol. ii, p. 143.

[2] *Ain*, vol. iii.

[3] There is apparently a good deal of confusion in translations from the Persian between Lion and Tiger, and apart from a few exceptional cases it is very difficult to say with any degree of certainty which of these two animals is referred to in any particular episode. Prof. E. G. Browne in his ' *Year among the Persians* ' states that the Lion is correctly ' *Shir* ' in Persian and the Tiger ' *Babr* '. He remarks that he makes special mention of this fact because ' *Sher* ' is applied in India to the Tiger, which animal is properly termed ' *Babr* ' in Persian.

[4] *Jehangir*, vol. i, p. 350.

[5] *Ibid.*, p. 371.

What has been rendered as cubit here is 'Dara' or 'Zara' in the text. A 'tassu' is 1/24 of a yard, and the length of this lion would therefore be about 10 ft. 3 in.

All translations of this work erroneously state that the animal of this adventure was a tiger, while the painting reproduced in the frontispiece and obviously depicting this very hunt proves conclusively that it was a maneless lion.

'It is related,' says Percy Brown[2] 'that Jehangir and his courtiers used to ride these beasts down and kill them with bows, carbines and lances. In all the shikar scenes of the Moguls, the animal is represented as the animal of their choice, pictures of tigers being extremely rare.'

Sir Thomas Roe who visited Jehangir's court as ambassador from James I of England, mentions how a lion and a wolf broke into his quarters one night while encamped at Mandu, and fell upon some sheep in the courtyard. He says, 'I sent to ask leave to kill them; for in that country none but the king may hunt a lion. Leave being granted I went out in the court; the lion quitted his prey and fell upon a little Irish mastiffe.'[3]

The Tiger

The tiger is also mentioned in Abul Fazl's chapter on the Fauna of Hindustan as being plentiful. He describes several methods of hunting the animal, the following of which were most commonly employed:—

1. Cage with sliding door and goat bait.
2. Poisoned arrows from bows set on trees on the tiger's path.
3. Bait surrounded with glued straw in which the tiger got more entangled the more he attempted to extricate himself, till at last the hunters came up and finished him off.

The faithful Abul Fazl adds that 'His Majesty (Akbar) from straightforwardness, dislikes having recourse to such tricks and prefers with bows and matchlocks openly to attack this brute which destroys so many lives.'

Yet another method, apparently not in common use is thus described: 'An intrepid experienced hunter gets on the back of a male buffalo and makes it attack the tiger. The buffalo will quickly get hold of the tiger with his horns and fling him violently upwards, so that he dies. It is impossible to describe the excitement of this manner of hunting the tiger. One does not know what to admire more, the courage of the rider or his skill in standing (?) firm on the slippery back of the buffalo.'[1]

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[1] *Jehangir*, vol. i, p. 285.

[2] *Indian Painting under the Moguls*.

[3] 'Sir Thomas Roe's Voyage to India,' *Pinkerton's Voyages*, vol. viii, p, 14.

The killing of a man-eater by Akbar in the neighbourhood of Ajmer in the year 157? is this recorded in Abul Fazl's picturesque words: 'On the way the scouts reported that there was a powerful tiger there that always lay in wait for travellers and killed them. Inasmuch as the extirpation of causers of evil is one of the duties of sovereignty, the prince went forward to destroy him, and did so.'[2]

Jehangir describes an instance of the most extraordinary behaviour on the part of a tiger at Agra in the year 1609. He says: 'They brought a tiger from my private menagerie to fight with a bull. Many people gathered together to see the show, and a band of Jogis (religious mendicants) with them. One of the Jogis was naked and the tiger by way of sport, and not with the idea of rage, turned towards him. It threw him on the ground and began to behave to him as it would to its own female. The next day, and on several other occasions, the same thing took place. As no such thing had ever been seen before, and was exceedingly strange, this has been recorded.'[3]

The same story is also related in the *Iqbal Nama* (p. 137) where it is stated that this particular tiger was one brought by a 'kalendar' (mendicant) as a present to the monarch. It had the name of 'Lal Khan' and was very tame. It is added that the tiger did no injury to the Jogi with his claws or teeth.

Jehangir gives the following instance of the breeding of tigers in captivity: 'It happened that a tigress became pregnant and after three months bore three cubs; it had never happened that a wild tiger after its capture had paired. It had been heard from philosophers that the milk of a tigress was of great use for brightening the eyes. Although we made every effort that the moisture of milk should appear in her breasts we could not accomplish it. It occurs to me that as it is a raging creature, the milk appears in the breasts of mothers by reason of the affection they have for their young as milk comes into their breasts in connection with their young ones drinking and sucking at the time of their taking (the milk) their (the mother's) rage increases and the milk in their breasts is dried up.'[4] The last sentence is very obscure.

Jehangir probably refers in the above passage only to the breeding of tigers captured in the adult state. The breeding of animals reared in captivity is by no means such a rare occurrence. The period of gestation according to Dunbar Brander is about fifteen weeks. Tigress's milk is still regarded as panacea for a great many eye troubles. The difficulty in obtaining it, however, has probably much to do with its reputed efficacy.

THE LEOPARD OR PANTHER. (*Felis pardus.*)

Abul Fazl mentions this animal as occurring in the Sarkar of Kashmir where it was tracked.[5] It is possible that the Snow

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[1] *Ain*, vol. i, p. 283. [2] *Ibid.*, vol. ii, p. 539. [3] *Jehangir*, vol. i, p. 157
[4] *Ain*, vol. i, p. 241. [5] *Ibid.*, vol. ii, p. 351.

Leopard is referred to. The tracking of this animal in the snow is still considered very good sport.

In the chapter on the Fauna of Hindustan, the animal is stated by the same author to be ' numerous '.[1]

Jehangir relates that on his return march from Kabul, from one of his periodical tours of inspection, a female panther (*yūz*) fell into their hands in the course of a hunt between the Garden of Wafā and Nimlah, in the neighbourhood of Jelalabad. ' The zamindars of that place,' he continues, ' Laghmanis, Shali and Afghans came and said that they did not remember, nor had they heard from their fathers, that a panther had been seen in that region for 120 years.' [2]

CATS

In the Fauna of Hindustan, Abul Fazl mentions that ' Cats, white and tawny and even winged that will fly a short distance are numerous.' [3]

The last evidently relates to the flying squirrel, which in Urdu is called ' Udti billi '—flying cat. This has been dealt with in its proper place.

LYNX AND CARACAL

These animals, the Hindustani name for which from the Persian is '*Siah-gosh*' (Black-ear), were extensively employed by the Moghul Emperors in the chase. According to Abul Fazl they were plentiful in Hindustan in Akbar's days and he states, 'His Majesty is very fond of this plucky animal for hunting purposes. In former times it would attack a hare or a fox, but now it kills black buck.'[4]

Both these species are still found within Indian limits, the Caracal according to Blanford in the Punjab, Sind, North-western and Central India ? and the greater part of the Peninsula except the Malabar Coast but rare everywhere, and the Lynx which has a more northerly habitat, in the Upper Indus Valley, Gilgit, Ladak, Tibet, etc.

THE CHEETAH OR HUNTING LEOPARD. (*Cynælurus jubatus.*)

The Moghul emperors were extremely fond of this animal, large numbers of which were kept at court for hunting purposes.

With regard to the capture of cheetahs, Abul Fazl observes : ' The ordinary pitfalls were liable to injure the animals severely and sometimes these managed to jump out and get away. Akbar invented a special sort of trap-door which closed when the cheetah fell into the hole. This pit was three gaz deep (about eight feet). Falling through the trap-door the animals were never hurt. On one occasion seven leopards—six males following a female—fell into a pit of this kind.'

Akbar was said to be able to train wild cheetahs in a much shorter time than was ordinarily required, and Abul Fazl relates an instance where 'a newly captured cheetah followed the emperor about without collar or chain to the astonishment of his court.'[1]

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[1] *Ain*, vol. iii.

[2] *Jehangir*, vol. i, p. 125.

[3] *Ain*, vol. iii.

[4] *Ibid.*, vol. i, p. 290.

The following account of a hunt with cheetahs is interesting inasmuch as it conveys some idea of the depth of interest Akbar took in this form of sport. Abul Fazl writes that '. . . at the time the army was encamped at Sanganir, His Majesty according to custom engaged in hunting. He was at this much devoted to hunting with cheetahs, and after assigning cheetahs to numerous parties, he went off himself with some special attendants. It chanced that they loosed a special cheetah called "Chitr Najan" at a deer. Suddenly there appeared in front of them a ravine which was twenty-five yards (gaz ?) broad. The deer leapt into the air to the height of a spear and a half and conveyed itself across. The cheetah in its eagerness took the same course, cleared the ravine and seized the deer. On beholding this astonishing occurrence the spectators raised a cry of amazement and there was great rejoicing and astonishment. The khedive raised the rank of that cheetah and made him chief of the cheetahs. He also ordered that as a special honour, and as a pleasure to men, a drum should be beaten in front of the cheetah.'

Fr. Monserrate, a Jesuit, who sojourned at Akbar's court for a considerable time refers to the Emperor's love for this form of sport and to the method of hunting, in the following words: 'Zelaldinus (Jelaluddin Akbar) spends enormous sums in keeping countless hunting panthers, for hounds such as those of the Gallic and Alan breeds are unknown in this country. The panthers are drawn by horses under care of the keepers to the place where the game is feeding. They are blindfolded so that they may not attack any one on the way. When they are freed they dash ravenously upon the quarry; for they are kept in a state of starvation.'

Speaking of the various kinds of animals in the albino phase that had come under his notice, which included hawks, quails, flying squirrels, black buck, chinkara and others, Jehangir mentions a white cheetah which was brought to him at Agra by one Raja Bir Singh Deo. He states that he had never seen a white cheetah before and describes the animal thus: 'Its spots which are usually black were of a blue colour, and the whiteness of the body was also inclined to bluishness.'

The breeding of a pair of cheetahs in captivity is recorded by Jehangir in the year 1613. This is a valuable record; Blanford says that they do not breed in captivity. 'It is an established fact,' writes the Emperor, 'that cheetahs in unaccustomed places do not pair off with a female, and my revered father (Akbar) once collected together 1,000 cheetahs.[2] He was very desirous that they should pair, but this in no way came off. At this time a male cheetah, having slipped its collar, went to a female and paired with it, and after two and a half months, three young ones were born and grew up. This has been recorded because it appears strange.'[3]

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[1] *Ain*, vol. i, p. 286.

[2] The *Iqbal Nama* (p. 70) has 9,000. It says that Akbar was so keen on their pairing in captivity that he even allowed some cheetahs to run about in the gardens without collars, letting them walk about and hunt after their fashion, but all to no purpose.

[3] *Jehangir*, vol. i, p. 240.

Writing in the time of the Emperor Aurangzebe, the traveller Mons. de Thevenot [1] states: 'There are a great many Forests about Ahmedabad where they take panthers for hunting, and the Governor of the Town causes them to be taught that he may send them to the king. The Governor suffers none to buy them but himself, and they whose care it is to tame them in the meidan where from time to time they stroke and make much of them that they may accustom them to the fight (?) of men.'

CIVET CATS

Mentioned by Abul Fazl in his Fauna of Hindustan.

The Moghuls were extremely fond of perfumes of all kinds and this animal was naturally well known to them for the musk it yields. No actual description of a civet cat is furnished by any of them, but from the fact that a number of animals have been compared to it for shape and size, it is obvious that they were well acquainted with the animal.

THE HYÆNA. (*Hyæna striata.*)

Mentioned by Abul Fazl in the Fauna of Hindustan.[2]

THE WOLF. (*Canis pallipes.*)

Mentioned by Abul Fazl in the Fauna of Hindustan.

The Emperor Jehangir records that he examined a male wolf killed by one Mirza Rustam Khan in the neighbourhood of the fort of Mandu to see 'whether its gall-bladder was in its liver like that of a tiger, or like other animals outside its liver. After examination it was clear that the gall-bladder was also inside the liver.'[3]

Sir Thomas Roe relates that while encamped at Mandu with the royal entourage, his servants killed a wolf that had broken into his camp and fallen upon some sheep in the courtyard. This animal was afterwards sent by him to the king (Jehangir).[4]

THE JACKAL. (*Canis aureus.*)

Mentioned by Abul Fazl in the Fauna of Hindustan.

THE WILD DOG. (*Cuon dukhenensis.*)

What is so fancifully described by Abul Fazl in his Fauna is very probably this animal. He writes 'Sardol is the name of an animal smaller than a dog, but preys upon lions and other wild beasts.'

Controversy on the subject as to whether wild dogs kill tigers or not is a flourishing evergreen. Competent authority maintains, however, that under very exceptional circumstances they may do so.

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[1] *Travels into the Levant*, licensed, December 2, 1686.

[2] *Ain*, vol. iii,

[3] *Jeh.*, vol. i, p. 364.

[4] *Pinkerton's Voyages*, vol. viii, p. 14.

THE FOX

Mentioned in Abul Fazl's Fauna.

THE OTTER

Mentioned in Abul Fazl's Fauna as being common.

Jehangir enumerating the animals met with on a march to Kashmir in the course of one of his periodical migrations, observes that he saw numbers of these '*sag-e-abi*' (i.e. water dogs) in the River Bihat (Jhelum).

THE BEAR

Abul Fazl mentions this animal is his Fauna.

THE FLYING FOX

The Emperor Babur appears to have suffered from the popular delusion regarding the status of this animal which he has placed amongst his birds. He described it thus : 'The Great Bat ; they call it "Cham-gidri". It is about the size of an owl, and its head resembles that of a young whelp. It lays hold of a branch of a tree on which it intends to roost, turns head undermost, and so hangs, presenting a very singular appearance.'[1]

THE FLYING SQUIRREL

In his enumeration of the Fauna, Abul Fazl refers to this animal as 'a winged cat that will fly a short distance.'

THE SQUIRREL

Babur describes our common palm squirrel as 'of the mouse species which they call "Galahri". It always lives in trees and runs up and down them with surprising nimbleness.'

'Gilehri' or 'Galahri' is the Hindustani name for the Common Indian Squirrel (*Scuirus palmarum*) and Mrs. Beveridge's suggestion that it may perhaps be *Vandeleura oleracea* which is a nocturnal animal rarely seen in daytime, is certainly untenable. Moreover I am not aware of any distinction being made in India generally between this latter species and a rat, and the name 'Galahri' undoubtedly suggests a squirrel.

THE HARE

According to Abul Fazl, this animal was plentiful in the Sarkar of Tattah (Sind) where the hunting of it was much pursued, lynxes and falcons being principally employed for the sport.

THE ELEPHANT. (*Elephas maximus.*)

Of all the animals Babur found in his new kingdom, the one that appears to have excited the utmost wonder and amazement in himself and his Tartar hordes was the elephant. It is possible that neither he nor his followers had ever beheld an animal before of such gigantic proportions, possessing such power behind his push, such a faithful ally in battle, and withal so tractable and docile. All of Babur's descendants shared with him this special regard for the elephant, and it has always figured prominently in all their State functions, peaceful and otherwise.

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[1] *Babur*, vol. ii, p. 222.

Babur thus describes the animal: 'As for the animals peculiar to Hindustan, one is the elephant. The Hindustanis call it Hathi which inhabits the district of Kalpi[1] and the higher you advance thence towards the east, the more do the wild elephants increase in number. That is the tract in which the elephant is chiefly taken. There may be thiry or forty villages in Karran[2] and Manikpur[3] that are occupied solely in the employment of taking elephants. They account to the Government for the elephants that they take. The elephant is an immense animal and of great sagacity. It understands whatever you tell it, and does whatever it is bid. Its value is in proportion to its size. When they arrive at a proper age, they sell it, and the largest brings the highest price. They say that in some Islands the elephant grows to a height of ten gaz (25 ft. I have never in these countries seen one above four or five gaz (10 or 12½ ft.). The elephant eats and drinks entirely by means of its trunk. He cannot live if he loses it. On the two sides of its trunk, in his upper jaw, he has two tusks; it is by applying these teeth and exerting all his force that he overturns walls and tears up trees; and when he fights or performs any operation that requires great exertion, he makes use of these tusks which they call '*aj*' (ivory). The tusks are highly valued by the Hindus. The elephant is not covered by hair or wool like other animals. The people of Hindustan place great reliance on their elephants; in their armies every division has a certain number with it. The elephant has some valuable qualities; it can carry a great quantity of baggage over deep and rapid torrents, and passes them with ease; gun carriages which it takes four or five hundred men to drag, two or three elephants draw without difficulty. But it has a great stomach and a single elephant will consume the grain of seven or fourteen camels.'

Sanderson found by experiment that a full-grown elephant consumes between 600 and 700 lbs. of fodder per day.

The measurements given by Babur are also in keeping with actual facts. There is a skeleton of an Indian elephant in the Calcutta Museum which measures 11 ft. 3 in. so that its owner must in life have stood quite 12 ft. in height. This is the largest Indian elephant known.

As regards the sagacity of the elephant, Babur's description falls short of Aelian's who in his attempt to endow the elephant with unusual mental perception, relates that an elephant after carefully watching its keeper wrote after him with his trunk letters upon a board.

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[1] A town of great historic interest on the right bank of the Jumna in the Jalaun District, U.P.—*King*.

[2] A town on the left bank of the Jumna in Allahabad District.—*King*.

[3] A town in Partabgarh District, Delhi.—*King*.

Both Blanford and Sanderson agree in believing that the intelligence of the elephant has been greatly overrated, its extreme docility being confounded with intelligence. From a comparison of the development of its brain it is assumed that an elephant is probably of lower intellectual capacity than other ungulates.

Babur had probably never seen a newly born elephant for it is an interesting fact that the young of both the Indian and African elephants have a complete coat of fairly long hair which disappears in a few weeks.

Only once does Babur make an allusion to the sport of elephant hunting. It is doubtful whether this refers to the killing of elephants with bows and arrows or other weapons, or to the trapping of the beasts. Elephant trapping was an ancient practise necessitated by the extreme utility of the captures to the possessors, and Aristotle's descriptions show that the methods of capturing then differed little from those in vogue at the present day. Then as now, tame elephants were used as decoys.

Abul Fazl mentions that 'Garha[1] is a separate state abounding with forests in which are numerous wild elephants . . .' and again that 'in the Sarkar of Bijagarh there are herds of wild elephants.'

He also describes an elephant hunt from which, it appears that there were several methods employed at the time for capturing these beasts. On the occasion referred to, Akbar's army which was encamped at Gwalior marched to Narwar where the elephant forests were. 'Arrangements for hunting were made and servants divided into several bodies. To each of them a great officer was appointed and several tame elephants assigned. Strong ropes too were provided for dragging purposes, and in case of need for nooses. An order was issued that whenever wild elephants were found, the tame one should follow it until it lost power of movement from weariness. Then from each side of the wild elephant, the drivers who were seated on the tame elephants should cast one end of the rope round the neck of the wild elephant and the other round the neck of the tame one. In this way to be brought to captivity and dragged along. Every day they were to tame him more and more and throw fodder before him till they could mount on him. This to occupy a short time. The real method of training every wild animal is gentleness and the exhibition of everything that is agreeable to him, such as grass, grain and water. On rational grounds this mode of hunting seems to be the best plan for hunting elephants; for the wild elephant is great of body and powerful, and is subdued by elephants more powerful than or like himself, the hunters avert his malignity from themselves and gain the victory over him. . . .'

The historian recounts that on the third day of this hunt, as Akbar was on horseback at early dawn, he came across a herd of over seventy elephants. These were ordered to be driven into a dense forest where the foot of each was secured to a tree. Watches were stationed over each animal till the tame elephants with ropes arrived from camp, when under Akbar's direction the elephants being firmly bound, each between two of the royal elephants, were conveyed to the camp by evening.

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[1] Ancient capital of the Gond dynasty of Garha of Mandla—*Imp. Gazetteer.*

It is interesting that in Belgian Congo where the Government are at present conducting experiments to tame and train the African elephant for work, the above method of capture is followed. Native hunters with nooses follow a herd for days until the animals are driven into dense forest where they can be approached, and as soon as an opportunity offers a calf's leg is lassoed and the animal firmly secured to a tree.

Abul Fazl enumerates the methods of capturing elephants as under :—

1. Kheddah. This method was practically the same as now employed.
2. Chor Kheddah. Here a driver lay flat on the back of a tame female which was driven into a herd of wild elephants. The driver secured a will one by throwing a rope round its foot.
3. Gadh—Pitfalls.
4. Bar.

Regarding the last he states : ' From times of old people have enjoyed elephant hunts by any of the above modes. His Majesty has invented a new manner which admits of remarkable finesse. In fact all excellent modes of hunting are inventions of H.M. A wild herd of elephants is surrounded on three sides by drivers, one side alone being kept open. At it several females are stationed ; from all sides male elephants will approach to cover the females. The latter then gradually go into the enclosure whither the males follow. They are now caught.'

In his ' Travels into the Levant ' published in the year 1686, and written probably in the reign of the Emperor Aurangzebe, Mons. de Thevenot describes the various methods of catching elephants as follows : ' Elephant hunting is variously performed. In some places they make pitfalls for them, by means whereof they fall into some hole or pit whence they are easily got out when they have once entangled them well. In other places they make use of a tame female that is in season for the male whom they lead into a narrow place and tie her there ; by her cries she calls the male to her, and when he is there, they shut him in by means of some rails made on purpose, which they raise, to hinder him from getting out, he having the female in the meantime on his back, with whom he copulates in that manner, contrary to the custom of all other beasts. When he hath done he attempts to begone, but as he comes and goes to find a passage out, the huntsmen who are either upon a wall or in some other high place, throw a great many small and great ropes, with some chains, by means whereof they so pester and entangle his Trunk, and the rest of his body, that afterwards they draw near him without danger; and so having taken some necessary precautions, they lead him to the company of two other tame elephants, whom they have purposely brought with them to show him an example, or to threaten him if he be unruly. There are some other snares besides for catching elephants and every country hath its way. The females go a year with young and commonly live about an hundred years.' This travelling gentleman's method No. 2 is doubtless an elaborated version of the 'Bar' above described. We can only hope that his description of the elephant's *modus copuli* is not a sample of his general veraciousness.

Writing of elephants, Fr. Monserrate the Jesuit from Goa, who lived at Akbar's court for a considerable time, observes as follows: 'The males go so violently mad for about three months of every year that sometimes they kill even their keepers; they are most useful for fighting at this period. When the time of madness is past, if they have to be enraged again on account of an impending battle, this is effected by giving them cats' flesh to eat mixed with their other food. They are kept quiet and harmless at home by the company of female elephants: for all their rage abates as soon as they see a female.

They live in herds in the forests, having a sort of joint family life, under the leadership of the father (as it were) of the herd and family, who is obeyed by his offspring and followed like a general in the wars which they carry on with other elephants. When they are hunted the herd retreats or attacks according to the command of this leader who marches with a proud and insolent air, like a true general in the midst of his forces, and seems to threaten all who approach. He paces slowly to and fro terrible to behold, and spares none but those who grant himself and his family feeding ground. Those are regarded the best which have low hind quarters and strong legs and necks. Strabo writes that their period of pregnancy is normally eight months, but sometimes six or ten: that the mother suckles her young for six months: that the female reaches maturity at ten years: that they live as long as a long-lived man: that some even reach 200 years: that their health is delicate: that they cannot be cured if once they become diseased. . . . Their young are at one year old, hardly as big as a pig. . . .'[1]

With regard to the period of gestation and the birth of an elephant, Jehangir records: '. . . a female elephant in the private elephant stud gave birth to a young one in my presence. I had repeatedly ordered them to ascertain the period of their gestation; at last it became evident that for a female young it was eighteen months and for a male nineteen months. In opposition to the birth of a human being, which is in most cases by a head delivery, the young elephants are born with their feet first. When the young one was born the mother scattered dust upon it with her foot and began to be kind and pet it. The young one for an instant remained fallen and then rising made towards its mother's breasts.'[2]

The following account of a hunt given by Jehangir is interesting more particularly in the fact that the locality where it took place has long since gone out of the wild elephant's range of distribution. Writing from camp at the village of Sajra (Sajwara ?), eight kos from Dohad, now in the Panchmahals District (Bombay Presidency), the Emperor says: 'I went to hunt elephants with a body of my private servants. As the grazing place of elephants is in a hilly country, with elevations and depressions, a passage is obtained with difficulty by one on foot. Before this, a large body of horse and foot had surrounded the jungle after the manner of a qamargah, and outside the jungle on a tree they had prepared a wooden platform for me. On all sides of this they had arranged seats on other trees for the Amirs. They had got ready 200 male elephants with strong nooses and many female elephants. On each elephant there were seated two elephant drivers of the tribe of Jarga, whose special employment is the hunting of elephants, and it had been arranged that they should bring the wild elephants from the jungle into my presence, that I might witness the hunt. It happened that at the time when the men from all sides entered the jungle, in consequence of the thickness of the forest and the heights and hollows, the chain was broken and the order of the qamargah did not remain perfect. The wild elephants in bewilderment turned in every direction, but twelve males and females came to this side (i.e. where Jehangir was). As the fear was that they might escape, they drove in the tame elephants and tied the wild elephants up wherever they found them. Although many elephants were not caught at least two excellent ones were captured, very handsome in shape, of good breed and perfect marks. As there is a hill in the jungle where the elephants were, called " Rakas (Rakshas) Pahar " or " Demon Hill " ; I called the two elephants " Ravan Sar " and " Pavan Sar ", these being the names of two demons.'

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[1] Commentary, p. 84.
[2] *Jeh.*, vol. i, p. 265.

The hill referred to is, as suggested by Rodgers and Beveridge, doubtless Pavagarh, a hill-fort in the Panchmahals District which is 2,800 ft. above sea level.

Jehangir left the place while the khedda operations were still in progress, and soon after he mentions that ' a report was received from Gajpat Khan, Superintendent of the elephant stables, and Baluch Khan, the chief Huntsman that upto this time sixty-nine elephants male and female had been caught. Whatever took place after this would be reported. I ordered them to beware not to take old or small elephants, but with this exception they should catch all they saw, male and female.'

With regard to the size of elephants Jehangir[1] says, ' In the elephant stables of His Majesty Akbar the largest elephant I saw was " Durjan Sal ". It was long the premier elephant. Its height was four yards (dara) and 3½ quarters of the ilahi gaz, which is eight yards and three fingers of the ordinary gaz. At present among the elephants of my establishment the largest athlete is " Alam Gajraj " which H. M. Akbar himself had caught. It is the chief of my special elephants. Its height is 4⅛ yards (dara) or 7 yards 7 fingers of the ordinary yard. The ordinary gaz (yard) has been fixed at twenty-four fingers' breadths of an average sized man and the ilahi gaz is forty fingers' breadths.'

This would make the height of ' Alam Gajraj ' about 11 ft. and that of ' Durjan Sal ' about 12¼ ft.

Jehangir mentions that one of his private [2] elephants Gajpati by name and a female that was with him in the stables were both bitten on the foot by a mad dog. The symptoms and effects of the bite recorded by him as follows are interesting: He writes, 'When a month and five days had passed after this event, one day when it was cloudy, the growling of thunder came to the ear of the female elephant that was in the act of eating, and it all of a sudden raised a cry and its limbs began to tremble. It threw itself on the ground but rose again. For seven days water ran out of its mouth, and then suddenly it uttered a cry and showed distress. The remedies the drivers gave it had no effect and on the eighth day it fell down and died. A month after the death of the female they took the large elephant to the edge of a river in the plain. It was cloudy and thundering in the same way. The said elephant in the height of excitement all at once began to tremble and sat down on the ground. With a thousand difficulties the drivers took it up to its own place. After the same interval and in the same way as had happened to the female elephant this elephant also died.' The Emperor concludes this account with 'Great amazement was caused by this affair, and in truth it is a matter to be wondered at, that an animal of such size and bulk should be so affected by such a weak creature.'

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[1] *Jeh.*, vol. ii, p. 18.

[2] *Ibid.*, vol. i, p. 242.

Two records of African elephants being brought to India are to be found in Jehangir's *Memoirs* (p. 323). One was a young individual brought as an offering by the Governor of Gujerat to the Emperor Akbar which we are told was very fiery and bad tempered when it grew up. The other was a small elephant presented to Jehangir in 1616 by one Muqarrab Khan which had been brought by sea from Abyssinia. Regarding these Jehangir observes that: 'In comparison with the elephants of Hindustan it presents some peculiarities. Its ears are larger than the ears of the elephants of this place, and its trunk and tail are longer.'

THE GREAT ONE-HORNED RHINOCEROS. (*Rhinoceros indicus.*)

Babur, as we know, frequently hunted this animal which he describes as follows:

'The rhinoceros is a huge animal. Its bulk is equal to that of three buffaloes. The opinion prevalent in our countries that a rhinoceros can lift an elephant on its horn is probably a mistake. It has a single horn over its nose, upwards of a span[1] in length, but I never saw one of two spans. Out of one of the largest of these horns, I had a drinking vessel made,[2] and a dice box, and about 3 or 4 fingers' bulk of it might be left.'

'Its hide is very thick. If it be shot with a powerful bow drawn up to the armpit with much force, and if the arrow pierces at all, it enters only 3 or 4 fingers' breadth. They say however, that there are parts of its skin that may be pierced and the arrows enter deep. On the sides of its two shoulder blades and of its two thighs are folds that hang loose, and appear from a distance like cloth housings dangling over it. It bears more resemblance to the horse than to any other animal. As the horse has a large stomach, so has this ; as the pastern of a horse is composed of a single bone, so also is that of the rhinoceros. It is more ferocious than the elephant and cannot be rendered so tame and obedient.' [1]

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[1] A span would be equal to 8½ or 9 inches. The record horn of *R. indicus* given in Rowland Ward's *Records of Big Game*, 7th. ed. is 24 inches length on front curve or equal to about 3 spans of Babur. It will be noticed here how guarded Babur is regarding the measurements he gives.

[2] In commenting on this Sir Lucas King observes as follows: 'The rhinoceros's horn was supposed to sweat on the approach of poison, a quality which fitted it in a peculiar manner for being made into a drinking cup for an Eastern king.'

As regards the distribution of the rhinoceros, Babur says : ' There are numbers of them in the jungles of Peshawar and Hashnagar, as well as between the rivers Sind and Behreh in the jungles. In Hindustan too they abound on the banks of the Saru (Gogra).'

Towards the end of Humayun's reign, in about the year 1556, a a Turkish admiral of Suleiman the Great, by name Sidi Ali Reis, who by the exigencies of war and weather, had found himself obliged to travel overland from Surat to Lahore and thence across all the intervening lands to Turkey[2] records that his party came across two rhinoceros near Peshawar, ' an event ' as Mrs. Beveridge observes ' which makes one wonder whether there still remained a part of the ancient lake of the plain of Peshawar to serve as habitat for the huge now vanished beasts.'

Compare the above distribution with the present sadly diminished territories of the animal, which are Burma, Assam and the Nepal Terai, nowhere of which can it be said to be really plentiful, except perhaps in the last named, where owing to its being strictly preserved as Royal Game, the rhinoceros is still to be found in fair numbers. In parts of Assam, too, owing to strict protection, its numbers are slightly on the increase.

The belief in the efficacy of the rhinoceros's horn against poison remained in England even upto the time of Charles II. In his *Science from an Easy Chair*, Sir E. Ray Lankester mentions that at that time a cup made of rhinoceros horn was handed over to the Royal Society for experiment, with the result of entirely disproving the superstition. The belief however, still exists in certain parts of India and in Oriental countries generally. In Tenasserim, where both *R. sondaicus* and *R. sumatrensis* are found, the Chinese pay big prices for the horn. The blood, urine and other fluids of the body are likewise preserved and greatly valued. The blood is believed to possess tonic and aphrodisiac properties and sells at about Re. 1 per tola dried. The animal when killed is turned on its back with its feet in the air. The viscera is carefully removed so as not to lose any of the precious fluids, and all the blood, etc., which flow down into the body cavity are scooped out and collected in hollow bamboos, or in the guts of the animal in the form of sausages, and smoke-dried. It is said that a dead rhino is worth anything from Rs. 900 to 1,200 to its hunters. Professional Siamese hunters, presumably having exterminated the rhinoceros in their own country, formed themselves into small roving bands and crossed over into British territory in the Mergui and Tavoy Districts of Lower Burma, and carried on the merciless slaughter of this animal on an extensive scale, and it was on this account that the Government of Burma had to pass legislation to protect it, making poaching a serious offence, and to appoint patrols in areas inhabited by these species.

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[1] *Babur*, vol. ii, p. 210.

With regard to Babur's comparison of the animal to a horse, Mrs. Beveridge in her translation of the *Memoirs* notes : ' The anatomical details by which Babur supports this statement are difficult to translate, but his grouping of the two animals is in agreement with the modern classification of them as 2 of the *Ungulata vera*, the third being the Tapir *F.B.I.*, *Mammals*, pp. 467–8, Blanford.'

[2] Vambery, *Travels and Adventures of Sidi Ali Reis*, Luzac & Co., 1899.

Writing in the reign of the Emperor Akbar, his chronicler Abul Fazl states regarding the Sarkar of Chambal: ' There is game in plenty and the rhinoceros is found. It is an animal like a small elephant without a trunk, and having a horn on its snout with which it attacks animals. From its skin, shields are made, and from its horn finger-guards for bow-strings, strings and the like '. The same author includes this beast in his Fauna of Hindustan where it is described thus: ' The rhinoceros is a stupendous creature ; he is twice the size of a buffalo, and much resembles a horse in armour. His feet and hoofs are like those of an elephant and his tail similar to a buffalo's, and he has a pastern joint like a horse. On the point of his snout he carries a single horn, and his hide is so thick that an arrow will not pierce it. Of this breast-plates and shields and the like are made, and he is bold enough to charge a man on horseback.[1]

The above description, as will be noted, closely resembles Babur's account, and may have probably been taken from his Memoirs.

The record Indian rhinoceros shot in Nepal measured 6ft. 4in. at the shoulder. A good sized bull buffalo measures 5 ft. or a few inches above.

The Emperor Jehangir mentions that one day he was hunting the rhinoceros from an elephant in the Kul Nuh Ban (Forest) in the neighbourhood of Aligarh. He says ' A rhinoceros appeared and I struck it with a bullet on the face (mana) near the lobe of the ear. The bullet penetrated for about a span. From the bullet it fell and gave up its life. It has often happened in my presence that powerful men (*jawānān*) good shots with the bow, have shot 20 or 30 arrows at them and not killed.' This took place about the year 1622 A.D. It has been stated that this animal was a wolf, but this is obviously incorrect. In Persian *Gūrg* is a wolf and *Kūrg* a rhinoceros. A wolf certainly would not require 20 or 30 arrows to kill it.

(*To be continued*)

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[1] *Ain*, vol. iii.

THE BIRDS OF BRITISH BALUCHISTAN

BY

CLAUD B. TICEHURST M.A., M.R.C.S., M.B.O.U., F.R.G.S.

PART II

(*With 2 Plates*)

(*Continued from page 711 of this Volume*)

Ploceus philippinus philippinus (L.) The Baya.

A male shot at Quetta on July 10, 1916 and a female at Sheik Mandah, August 6, 1914, are the only records of this weaver. I have examined both these birds in the Quetta Museum and could see no signs of their having been in captivity. Weavers are very likely to be resident at Sibi (I have seen nests close to the upper Sind–Baluchi frontier) so perhaps odd ones stray up to Quetta occasionally.

There is no record of any Weaver in the rest of Baluchistan, it might well occur in Las Belas ; Zarudny however mentions old Weavers' nests of unknown species in South Persian Baluchistan.

Ploceus manyar flaviceps (Less). The Striated Weaver Bird.

Radcliffe records that a pair of these Weavers were seen at Samungli four miles west of Quetta on July 17, 1913 and suggests that they were escapes from the bazaar ; very likely.

Uroloncha malabarica, L. The White-throated Munia.

In the Quetta valley there are records of this Munia in July, August, September and January. In small numbers and locally it may be resident ; Cumming found a nest at Babli on August 16. On the Ziarat Road Meinertzhagen saw large flocks at Khawash (7,500 ft.) on July 31. It is common at Sibi and at Fort Sandeman.

Duke and St. John both met with it at various places in Kalat (up to 5,790 ft.), and Hotson found it in S. Kalat and Jhalawan where it was not uncommon in August and September and is doubtless resident. In the Habb Valley I found it quite common and it occurs in the Las Belas Plain but how far, if at all, it extends along the Makran is not known ; no one has recorded it from west of Las Belas.

Amandava amandava amandava, L. The Indian Red Munia.

Radcliffe says that this Munia is frequently seen in small flocks in the Quetta valley and he has obtained specimens in November. Probably it is an irregular wanderer from the plains and may well be resident at Sibi.

No records elsewhere and I failed to find it west of Karachi.

Coccothraustes coccothraustes humii, Sharpe. Hume's Hawfinch.

Murray records the Hawfinch on the Khojak in April and May ; and Barnes says it is common in the hills. This is probably correct as there is a specimen in the Karachi Museum labelled Chaman. It occurs at Fort Sandeman whence there is a specimen in the British Museum ; Meinertzhagan obtained a straggler at Quetta on March 1. Marshall's records do not refer to this species. The Hawfinch is probably very local and not very common (as in most places) in the wooded hills.

Mycerobas carnipes speculigerus, Brandt. The White-winged Grosbeak.

This fine Grosbeak is resident in the highest hills of N. Baluchistan from Harboi in Kalat, on Khaliphat, Murdan, etc., and the Ziarat District and probably beyond. It is not uncommon where found and breeds in June at

9,000–11,000 ft. In winter it is said to descend to lower levels but it never reaches the Quetta Valley. Meinertzhagen records a nest with four eggs on June 7 as being a cup made of fine twigs and coarse grass lined with fibre and placed on a branch of a juniper 5 ft. from the ground. I came across small parties of this bird in autumn at Ziarat associating with *Turdus atrogularis* in the juniper trees and feeding on the orange berries of a bush so common in the forest ; they seemed rather secretive and shy.

Baluchi birds and those from Tian-shan and Gilgit on the one hand differ from those from Sikkim on the other in that the females are paler on the breast and vent ; the wing measurements of the two series of females are the same, viz., W. 116–123 mm. the type of *carneipes* came from Nepal whence the specimens examined are few and poor, but I think that they are the same as Sikkim birds. I think *speculigerus* may be used for the Baluchi bird and for those from the N. W. Himalayas.

Carpodacus rhodochlamys grandis, Blyth. The Red-mantled Rose Finch.

The distribution of this Rose Finch in N. Baluchistan appears to be the same as that of the Grosbeak, and it breeds at similar elevations but in winter it moves down more and is occasionally found in the Quetta Valley. Meinertzhagen records nests early in May in wild briars. In the autumn I found it only at the highest part of the Ziarat juniper forest ; small parties were met with in the thickest juniper trees often feeding under them close to or on the ground.

C. rhodochlamys rhodochlamys has been recorded from Quetta ; I have examined the supposed example in Quetta Museum and consider it to be *grandis*.

Carpodacus erythrinus roseatus (Hodg.) The Common Rose Finch.

Information concerning the Common Rose Finch is not as full as it might be. In N. Baluchistan it must breed fairly commonly in the higher hills ; Col. Venning obtained several specimens between June 4 and July 14 at Shinghar (Fort Sandeman District) where the birds must have been nesting ; Marshall records it as common in May at Ziarat so it may breed there too. I saw a large flock in the forest there in September. Meinertzhagen records that he often saw this species round Quetta in the summer—presumably on the higher hills.

To the Quetta Valley and Kandahar it is a fairly common passage migrant in April and again at the end of August and in September, but there are no winter records in the north.

Over the rest of Baluchistan there is still less information. Cumming has obtained it at Ormarra on October 1 and found it not uncommon at Charbar in winter.

Buchanetes githaginea crassirostris, Blyth. The Trumpeter Bullfinch.

The Trumpeter Bullfinch is apparently rather local and not very common in N. Baluchistan though Barnes records it common at Chaman ; it may well be commoner than records indicate as I have found it easily overlooked except when coming to water. It is no doubt more or less resident moving about locally. Meinertzhagen has seen it at Kushdil Khan and Azim in July and June and W. D. Cumming at Saranan also in June so it must breed in these localities and also at Kalat whence I have seen specimens in May and early August. It is recorded from the Pishin Valley in September and Kandahar in February. Williams records a nest with four eggs at Sheik Mandah on May 14 ; the nest was among the rafters of an old out-house, he says it also nests in vineyards in Pishin Valley.

To the Makran coast it is a winter visitor from the Habb Valley in the east to the Persian frontier, so far as is known, though it probably breeds in the hills at no great distance away. In Central Baluchistan its status is unknown but I have seen a specimen from near Khozdar (Jhalawan) obtained on September 30. Cumming renders the call-note as ' stand-at-ease.'

Buchanetes mongolicus (Swinh.) The Mongolian Trumpeter Bullfinch.

Barnes records this Desert Bullfinch as not uncommon at Chaman and two were obtained there on April 8, 1880, by Murray (now in British Museum). I met with a large flock on rather bare stony ground by the tank at Hanna near Quetta on December 13, 1917 and obtained two specimens. W. D. Cumming sent me another from Saranan on March 1, 1924. Status not clear ; winter visitor ?

Rhodospiza obsoleta (Licht.) Lichtenstein's Desert Finch.

This Rose-finch, known locally as the Quetta Rose-finch, is not uncommon and resident, but is only recorded in the district, Quetta to Kandahar. At Quetta the numbers are said to be augmented by spring arrivals in March. It appears to be subject to local migrations when the young are flown, and is said to leave the Quetta Valley at the end of July until September; certainly I searched in vain for it in mid-August. At Sheik Mandah where it breeds commonly W. D. Cumming noticed the same thing.

In some years nest building begins as early as the first week in March but the last week of April is the more usual time for first full clutches of eggs; young have been found however by April 28 and May 9. W. D. Cumming has noted a second nest being built on May 22, while the young of the first brood were still being fed and has found fresh eggs on June 18. It is a garden bird nesting in pollarded vines, roses, almond, apricot, etc., from 3 to 10 feet up and also in roadside trees; the clutch is 5 to 6 sometimes 4 or 7. The nest is a typical finch nest composed of sticks, twigs, grasses and lined with cottonwool and hair or feathers; one nest examined by me was made mainly of native cotton and string incorporating a few tamarisk twigs and bits of rag and lined with wool. The eggs vary from palest sea-green to nearly white marked at the larger end with dots and scrolls of brownish-black, sometimes very sparsely. Nineteen eggs measure max. 20·5 × 15 mm., 18 × 14·5 and 19·5 × 14. Williams records a young cuckoo in a nest of this species.

It has been recorded as common at Chaman in spring and autumn and at Kandahar throughout the year.

THE GOLDFINCH

Carduelis caniceps caniceps (Vig.).
Carduelis caniceps subulata (Gloger.).
Carduelis caniceps paropanisi (Koll.).

The status of this Goldfinch is not clear; most observers state that it is a winter visitor in fair numbers from early November to mid-April to Quetta, Chaman and Kandahar; Radcliffe however says that it is found in summer in the higher valleys and that at Ziarat he thought that it was breeding. Hotson too thought he saw it there in the last week of July. Further information and specimens are needed to clear up the point. Elsewhere in Baluchistan there are no records.

In spite of its being a fairly common bird few specimens are available to determine what races occur. One, obtained by Meinertzhagen, is very large and pale, ♂ W. 87·5 mm. and is I think-*C. c. subulata* (=*orientalis*, auct.); this is the only one I have seen of this race. Three others are distinctly darker and smaller, ♂♂ W 82·5–83·5 and match well birds from Tian-shan and I consider them to be *C. c. paropanisi*. Two others again W. 79 and 82 are darker still and match well the Himalayan bird *C. c. caniceps*; (*subcaniceps* of Zarudny appears to be the same) or *paropanisi;* at least a series from Ferghana are quite the same as a series from Tian-shan and measure 80–86 (Ferghana) and 81–86 (Tian-shan).

Carduelis carduelis major (Tacz.). The Eastern Goldfinch.

One of a pair, from a flock of *caniceps*, obtained by Meinertzhagen on February 27, at Quetta, is the only record.

Acanthis cannabina fringillirostris (Bp. and Schleg.). The Eastern Linnet.

The Linnet is evidently a rare winter visitor. Meinertzhagen records a flock at Quetta on February 14; he obtained a male at Chaman on April 2, and there is another in the Quetta Museum obtained on March 31. No records elsewhere.

[C. E. Williams records that he saw an Eastern Twite in N. Baluchistan in June. There are no other records of this species which I cannot include on one 'sight record'.]

Serinus pusillus (Pall.). The Red-fronted Serin.

The Red-fronted Serin is common and resident, breeding in the higher hills of N. Baluchistan—Ziarat, Zarghun, Takatu, Murdan and probably the

Khojak and elsewhere at 8,000 to 10,000 ft. It descends to lower elevations in winter and in severe weather at all events enters the Quetta Valley, and the Kandahar Plains. Meinertzhagen record a nest on May 10, situated in an oleander bush, 3 ft. from the ground. In the autumn these birds congregate into small flocks and are very partial to the sides and bottoms of the *tangis* in the forest, feeding on grass seeds, etc., and they are very fond of clumps of wild briars in which too they seek their food. On being disturbed the flock will invariably fly up to the bare top of the nearest juniper. At Chaman it is recorded in spring and autumn in agricultural fields as they move up and down from their nesting ground. No records elsewhere.

Fringilla montifringilla, L. The Brambling.

The Brambling is a common winter visitor to the Quetta Valley frequenting gardens, orchards, etc., and the roadside. In December 1917 it seemed to me to be the commonest small bird in the valley. It is recorded from Kandahar and Fort Sandeman and probably occurs elsewhere in N. Baluchistan at not too high an elevation. It arrives early in November and leaves at the end of March, latest April 2.

Gymnorhis xanthocollis transfuga (Hart.). The Yellow-throated Sparrow.

The Yellow-throated Sparrow is decidedly uncommon in N. Baluchistan. Murray records it from Sagee near Gulistan and the Khojak early in April but says it was rare and only seen in the plains. St. John only recorded it from Kandahar. Meinertzhagen obtained one from a small flock at Quetta on March 2. It occurs at Sibi and is probably not uncommon there. The status beyond the Bolan Pass is probably a rare summer visitor.

Throughout Central and Coastal Makran however it is found locally where trees occur and is resident. Its distribution can be traced from Sind right through the Makran to Charbar, Jask, Bampur and Shiraz to Fao, Busra and Baghdad. At Charbar W. D. Cumming informed me it was only a passage migrant and in Iraq it is only known as a summer visitor.

THE HOUSE SPARROW

Passer domesticus indicus, Jard.

Passer domesticus parkini, Whistler.

'Gingishki', Bal.

To Kandahar, Chaman, Quetta Valley and the hill country generally of N. Baluchistan the House Sparrow is a very common summer visitor arriving in the second week of March at Quetta, first week of April at Kandahar. Meinertzhagen records that on arrival at Quetta they frequent hillsides before drawing in to the town to dispute possession of nesting holes with the resident Tree Sparrows. It is certainly of the two much more a country bird, the roadside trees being full of their nests—a thing I never remember seeing in the plains of India—while in the autumn swarms may be seen in every field to the entire exclusion of the Tree Sparrow. But besides habitations and trees, holes in earth banks are used and even cliffs at 10,000 feet. Full clutches of eggs may be found by the second week in May. Most must depart in September and Cumming has noted them collecting and migrating by September 9 but I saw some still at Ziarat (9,000 ft.) on October 7. Nor do quite all leave Quetta in winter for I saw a few, the only ones however, on December 14 at the railway station. It is common and resident in the Sibi plain but at stations between Sibi and Jacobabad I saw in small patches of cultivation on September 24, far more Sparrows than could possibly have been bred locally and these were no doubt migrants from the hills. I saw an albino at Spintangi.

How far south the House Sparrow ceases to be a migrant and becomes resident I do not know but it is fairly common throughout Central and Coastal Makran wherever there are habitations, as well as in the Nushki Plain. In Coastal Makran it is at all events resident. W. D. Cumming informed me that there were no House Sparrows at Ormarra prior to 1901 but since then it has become common.

The question arises what race of House Sparrow inhabits Baluchistan? In the plains of India we have a small and resident race *indicus*. In the higher parts of the Himalayas we find a larger and migratory bird which Mr. Whistler has named *parkini* (type loc. Cashmere) but as we should expect with a bird of continuous distribution some places are inhabited by intermediate sized birds. Turning now to Baluchistan there is no doubt that *indicus* goes along the Mekran coast to Gwader and beyond and the few I have seen from Central Makran are *indicus* too. But birds from Kalat, Quetta and Kandahar are large 13 ♂♂, W. 77–82 (most 79–82) though Meinertzhagen tells me he has a ♂, W. 72, an abnormal bird. 30 ♂♂ from the plains of India measure W. 72–78 (most 75–77).

Passer hispaniolensis transcaspicus, Tschusi. The Spanish Sparrow.

I think the Spanish Sparrow has been largely overlooked in Baluchistan or else it is unaccountably rare. Mr. J. W. Nicol Cumming obtained three at Sheik Mandah on November 3, 1913 and his brother recorded them there on October 24, 1923 and obtained specimens on March 1, 1924. Watson records it as a winter visitor at Chaman from October to December. On the other hand St. John says it is common at Kandahar in summer and Swinhoe says it arrives there in large flocks with the House Sparrow, i.e., in April ; St. John was probably referring to this and not implying that it bred there.

In British Mekran I have no record though this species must surely occur ; Hotson however met with large flocks in January at Geh on the Persian side and Zarudny says a few breed in the Karwander District (N. of Bampur.)

There can be little doubt that the Afghan Scrub Sparrow (*Passer moabiticus yatii*) will be found within our limits ; Zarudny found it at the following places some of which are only just over the British frontier, in Persian Baluchistan and Makran—Naranu and Mok Sultan in Mashkel Valley district; Jalk ; Rud-i-Kalugan ; nr. Dizak ; Rud-i-Sarbas ;—all in winter and he found no evidence of nesting there. One might expect it too in the Chaga District west of Nushki.

Zarudny records too the Sind Scrub Sparrow (*Passer pyrrhonotus*) from the Zaristan district and from Lekuball where he found supposed old nests. I know of no record between these places and the Indus.

Passer griseigularis has been obtained at Kandahar in April but not so far in Baluchistan.

Passer montanus dilutus, Richm. The Tree Sparrow.

The Tree Sparrow is resident in N. Baluchistan between 5,000–7,500 ft. and is the ' house sparrow ' of the country. There is some slight elevational movement in winter when the numbers at Quetta and Chaman are augmented by visitors. It breeds in holes in trees, but more often under eaves, holes in buildings, etc. Eggs are recorded from April 2 to June 4 (Meinertzhagen). In August I found it very noticeable that all the Sparrows of the streets and compounds at Quetta were all Tree Sparrows and the Sparrows of the country side were all House Sparrows.

How far south of Kalat it is resident I do not know but small numbers evidently visit the Makran coast in winter at which season Cumming occasionally saw them at Ormarra.

Zarudny named the bird from the Iranian plateau as *pallidus* it being between *montanus* and *dilutus* in colour ; Baluchistan specimens however do not differ from those from Turkestan.

Although I have no records within British Baluchistan of the Desert Rock Sparrow (*Carpospiza brachydactyla*) yet it is likely to occur as W. D. Cumming found it resident as near as Charbar where he obtained specimens in April and October. Further on at Jask it is evidently common as on April 10, 1910, he found six nests. These he tells me were cup-shaped and situated in small desert bushes 1½ to 2½ feet from the ground ; the eggs number 4 to 5 and have a white ground with minute brown spots especially towards the larger end. It is an early breeder as incubated eggs were found on April 1, and young, ' covered ' with yellow down, on April 10, while other nests on that date had fresh eggs.

Petronia petronia intermedia, Hart. The Rock Sparrow.

One was obtained by Lloyd at Quetta on March 14, 1910, and is in the Quetta Museum ; Meinertzhagen obtained another there on February 28, 1914. Murray records a pair at Sagee on April 2, 1880. Swinhoe says it is a winter visitor to Kandahar. Apparently a rare straggler.

Bombycilla garrulus centralasiæ, Poljakov. The Waxwing.

Meinertzhagen records that he obtained one of a pair at Quetta on November 11. No other record of this straggler, which Whitehead and Magrath met with in the N. W. F. Province.

The Snow Finch (*Montifringilla nivalis alpicola*) occurs in the *Hand-list of Indian Birds* as ' breeding from Caucasus to Baluchistan.' I know of no record of this species in Baluchistan.

Emberiza schæniclus pallidior, Hart. The Reed-Bunting.

The Reed-Bunting appears to be uncommon or else overlooked. There is one in the Bombay Museum collected by Watson at Chaman and there is one in the Quetta Museum from Sheik Mandah (labelled *E. stracheyi !*) obtained on November 15. Murray recorded it as common near Mach ! W. D. Cumming obtained three at Saranan on March 2, 1924. Swinhoe lists it as a winter visitor to Kandahar.

Emberiza leucocephala, Gm. The Pine Bunting.

The Pine Bunting is a winter visitor in fair numbers but is only recorded from Kandahar and the Quetta district. Extreme dates of arrival and departure are November 11 and April 28.

I saw a flock at Quetta in December picking over droppings on a horse exercising ground and others in willow trees flying out and taking insects on the wing.

One received from W. D. Cumming obtained at Urak on February 19, 1924, is exactly intermediate in characters between *citrinella* and *leucocephalus* and would do for an abnormal bird of either species except for its larger size. It is a female W. 92, i.e., the size of *leucocephala* ♀ from which it differs by the pale yellow wash on the whole of the underparts while the chestnut colour on the upper breast is almost absent ; also the bases of the crown feathers are yellow. It differs from *citrinella* ♀ in having less yellow on these parts and on the underwing, besides being larger. Such hybrids, as I take them to be, are fairly well known.

Emberiza stewarti, Blyth. The White-capped Bunting.

The White capped Bunting is a very common summer visitor to N. Baluchistan arriving in the hills at the end of April, earlier at lower elevations, and breeding on all the hills between 7,000 and 9,000 ft. Nests recorded as early as May 10, and as late as June 29 ; at the end of the first week in October it was still very common in the juniper forest at Ziarat and appeared to be the chief prey of the Sparrow Hawks ; but some must leave earlier as I have seen a few in the Quetta Valley already by August 19. It seems that most leave Baluchistan for the winter though odd ones are recorded at Quetta in December but where they go to is not clear ; there are no records of it in Central or South Baluchistan at that season, only one record in Sind and Mr. Whistler never found it in the Lower Punjab. It may possibly winter in the low hill country north of the Sibi Plain.

Emberiza cia per, Hart. The Meadow Bunting.

Though recorded as extremely common in N. Baluchistan by Murray. the Meadow Bunting appears to be quite rare. Watson records it from Chaman and I have seen two in the Quetta Museum, obtained at Baleli on December 9, and at Quetta on February 24, and one in the British Museum obtained by Col. Venning at Fort Sandeman on December 26. Meinertzhagen obtained a fourth at Quetta on March 11.

This Bunting is probably commoner than these records indicate and it must breed as near our area as S. Waziristan whence there is a bird in the Bombay Museum obtained on the Marwatin River on June 29, 1918. St. John too obtained a young bird at Kowur Kalat (where ?) on June 19, 1881.

Emberiza buchanani, Blyth. The Grey-necked Bunting.

N. Baluchistan would appear to be the eastern fringe of this bird's breeding distribution ; Barnes says it is very common at Chaman arriving at the end of March and he believed it bred in the hills, i.e. the Kwaja Amran, and he found a nest on the Khojak which he attributed to this species. It is not clear that it breeds in Kalat where however it is common on spring passage in April.

Meinertzhagen considered it to be a scarce summer visitor round Quetta where he found a few pairs breeding in rock and low bush country between 5,500 and 8,000 ft. such as at Takatu, Spereragha, etc. He found a nest with one egg on May 9, another with four on June 11, and a third with young on May 30. Though Newnham recorded it as overwintering at Quetta most leave entirely, but I have notes of odd ones up till November 7.

In Central Makran it is doubtless a passage migrant ; Hotson met with it in September in Jhalawan and in the valley of the Hingol. Cumming records it in small numbers at Ormarra in Coastal Makran during September and at the end of March and also at this time at Charbar.

Emberiza aureola, Pall. The Yellow-breasted Bunting.

The only record of this Bunting comes from Ormarra on the coast where Cumming obtained one on November 14, 1901 ; now in the British Museum.

Emberiza melanocephala, Scop. The Black-headed Bunting.

'Zarden drushk,' Bal. (= small yellow bird).

In N. Baluchistan the Black-headed Bunting is a spring and autumn passage migrant but although Barnes said he found it very common at Chaman in spring the evidence of others seems to point to its not being at all abundant. Swinhoe too found it uncommon enough to mention each individual and St. John lists it as very rare in N. Kalat. Such as pass this way are met with in April and early in August.

The main migration westward certainly passes further south ; in S. Kalat and Jhalawan, Central and Coastal Makran this bird passes through in swarms, males first, during the last week in March and during April, as it does in Sind, but it has been noted at Ormarra as early as February 22. At Charbar Cumming noted the main passage as from March 26 to April 27. Further on at Bampur in Persian Baluchistan Blanford met with great numbers on April 14, passing through from the S.E. to reach their breeding grounds in the Persian Highlands. The return migration in Makran begins at the end of July and lasts to the third week in September. As in Sind so in Baluchistan this bird does not overwinter but passes on to Central India.

Emberiza icterica, Evers. (= *luteola*, auct.) The Red-headed Bunting.

The Red-headed Bunting is a local summer visitor throughout N. Baluchistan, breeding at between 5,500 and 8,000 ft. ; it arrives from mid-April onwards and is fairly common on passage in the Quetta Valley and at Chaman. It is recorded as fairly abundant in the nesting season between Kach and Ziarat but I found by September 24 all had already gone. The latest record I have is one from the Quetta Valley on November 11. This species must take a S.E. route to reach its winter quarters in the plains of India as it is unknown in Central and S. Baluchistan and practically unknown in Sind. I am indebted to W. D. Cumming for notes on the nesting of this Bunting ; he found it breeding not uncommonly at Sheik-Mandah near Quetta. On arrival it starts building at once and the earliest nest found was on May 8 and this on the 21st held 3 eggs ; the last week in May is the usual time for full clutches. The nests are well concealed in garden hedges, rose bushes, vines and not uncommonly 2 to 4 feet up in a fork of peach trees growing in wheat-fields. The male usually sings in the vicinity of the nest. A nest sent is composed of weed stalks and fibres and is lined with goat hair. Five is the usual full clutch. The eggs are white tinged with green and finely freckled all over with pale sepia and yellowish-brown, more at the larger end, and there is no scrolling as is seen in other Buntings' eggs ; they measure 21·5 × 15·5 to 22·5 × 15·5 and 22 × 16.

Emberiza striolata striolata (Licht.) The Striated Bunting.

In the north the Striated Bunting would seem to be local ; it is not a bird of very high elevation and to the Quetta Valley it is but a straggler (obtained twice), though Marshall says it is not uncommon in the hills near Quetta in summer. Murray called it very common but he probably was referring to the Bolan Pass where it might well be fairly common ; I saw it on the Nari River below Spintangi in September. Not recorded at Kandahar.

From S. Kalat southwards it is fairly common from the Khirthar on the east to the Persian border and beyond. It doubtless is more or less resident

IN THE JUNIPER FOREST, ZIARAT
HOME OF *M. carneipes Æg. leucogenys,*
Carpodacus grandis, ETC.

ON THE EDGE OF THE JUNIPER FOREST,
CHUKOR GROUND

A 'TANGI' IN ZIARAT FOREST

KHIRTHAR RANGE, SIND-BALUCHI FRONTIER.
TYPICAL *Œnanthe alboniger* GROUND

moving altitudinally and locally down in winter when it is a bird of barren hillsides and sandy wastes. Duke obtained it in S. Kalat in the nesting season.

Delichon urbica, L. The House Martin.

House Martins are said to be seen occasionally in the Quetta Valley and Marshall obtained one some years ago. It must be a rare bird as no one else has since met with it though Nicol Cumming says that it breeds in the hills near Quetta. This however needs confirmation. Baluchistan must be on the eastern fringe of this bird's distribution on passage.

Riparia riparia riparia (L). The Sand Martin.

Riparia riparia diluta (Sharpe and Wyatt.) The Pale Sand Martin.

Sand Martins do not appear to be common in N. Baluchistan ; Meinertzhagen obtained two birds on August 1 and 4, which are too dark for *diluta* and not distinguishable from the typical race which must just fringe Baluchistan on passage.

Nicol Cumming records that Sand Martins breed near Quetta in April, but I know of no actual records of nests ; breeding colonies must be few and far between as no one else has recorded it as nesting though Meinertzhagen obtained a specimen of *diluta* on June 11, and saw a party of 10 and on June 24, he obtained a juvenile. Murray records it from Mach on March 17, and Swinhoe noted the arrival at Kandahar at the end of March ; all his specimens are *diluta*. Hotson records it from Dalbad (2,900 ft.) on April 16. I saw a single bird at Khawas near Ziarat on September 28. It has been obtained at Fort Sandeman.

In Coastal Makran W. D. Cumming has noted Sand Martins in March and April while I found *diluta* common in the Habb Valley in winter as did Hotson in the Makran. There is a specimen from Charbar in the British Museum.

Riparia chinensis (Gray.) The Indian Sand Martin.

Murray records that he obtained the Indian Sand Matrin at Sibi and Pir Chowki at the entrance to the Bolan. He distinguished them from *diluta*. This bird may well occur at Sibi and in the Sibi Plain as it is exceedingly common in Upper Sind. It does not breed in Lower Sind, west of the Indus and so probably is not found in Las Belas.

Ptynoprogne rupestris (Scop.) The Crag Martin.

The Crag Martin is a fairly common summer visitor to the hills of N. Baluchistan breeding at from 6,000 to 10,000 ft. in cliffs and sides of the 'tangis.' Betham records a nest with four fresh eggs on May 31, and Marshall a nest with young on May 27. Meinertzhagen has noted birds incubating as early as May 3, and young in the nest on July 24, so probably more than one brood is reared. At Ziarat I found it still fairly common on October 6, and Zeugmayer obtained it at Kalat on the 7th ; an odd one is recorded at Quetta in December.

Unrecorded in Central and Coastal Makran ; possibly it takes a more eastern route.

Ptynoprogne obsoleta pallida, Hume. The Pallid Crag Martin.

The Pallid Crag Martin replaces the last in Central and Coastal Makran and probably in Jhalawan and is common and resident right through to the Persian boundary and beyond. In winter at all events it may be seen in the plains and even hawking over the shore, at which season it occurs in Las Belas to the Sind boundary. It may even breed on the coast as it certainly does according to W. D. Cumming at Jask in Persian Makran where a pair always nested in his verandah. Blanford records birds in breeding state at Jask and Kalayan on March 12, and Hotson obtained it at the end of April in Central Makran ; I have no records of any nests but Hotson says it nests in 'Karez' pits.

In N. Baluchistan this bird's distribution is peculiar. Murray records it from Kondalanee in the Bolan Pass (900 ft.) and there is a specimen from there in the British Museum and it may well occur both there and along the foothills bordering the Sibi Plain as it does in similar places in Sind in winter. Further north it is not recorded until S. Afghanistan is reached where the Afghan-Baluchi Boundary Commission obtained it, and St. John obtained it at Kandahar on May 3, where presumably it breeds.

Compared with Egyptian birds (*obsoleta*) obtained at the same time of year Baluchi birds are *darker*; these Crag Martins darken with wear and winter. Baluchi specimens are the same shade as Egyptian May birds, however if compared in similar states of plumage the two forms are easily separable. Unfortunately the Baluchi birds must bear the inappropriate name of *pallida !*

Hirundo rustica rustica. L. The Common Swallow.

' Kir Kishi ' (Brahui), also ' Totaki.'

The Swallow is a common summer visitor to N. Baluchistan usually arriving at the end of February or beginning of March ; Swinhoe however saw it already by January 29 at Kandahar and nesting numerously by February 10. St John in another year records the first arrivals on February 7. It probably settles down at lower elevations earlier than at Quetta. It nests in houses, culverts and commonly in the Quetta bazaar and ranges up to 7,000 ft. Swinhoe records a nest in a tent (cf. ' *Birds of Mesopotamia*', J. B. N. H. Soc., vol. xxviii, p.296.). Eggs are recorded at Quetta from March 23 to June 2, so more than one brood is reared. It breeds in the Bolan Pass but how far down towards the Sibi Plain is not known; it probably winters in the latter locality where I found it common in October. Meinertzhagen says all have left the Quetta Valley by the end of August.

In the Mekran the Swallow certainly breeds at Mand and Panjgur as well as at Kalagan and Jask just on the Persian side, at elevations of 2,750 to 3,500 ft. thence to the coast at Gwadar at sea-level ; further west than this it is resident and breeds at Charbar and Jask. Possibly it breeds further east on the coast than Gwader as Butler saw one at Astola Island off Pasni on May 29. So far as I can trace it the breeding range in Baluchistan lies north and west of a line drawn from Gwader to Sibi. South and east of this line it is a winter visitor to Coastal Makran and Las Belas, but information is lacking over the rest of this area.

A Brahui verse runs :—

' Cat-footed Swallow, come sit on my door,
' Give me a piece of mutton fat for my feet are cracked.'

What is the legend behind this ?

Hirundo smithi filifera, Steph. The Wire-tailed Swallow.

The Wire-tailed Swallow is a scarce local summer visitor to N. Baluchistan. It is recorded by Nicol Cumming as nesting at Harnai ; in the Quetta Valley on the Lora River I found several pairs nesting in the ' karezas ' entering the river and on August 18 examined an empty nest. It is unrecorded elsewhere till Kandahar is reached where St. John obtained a specimen on May 12, and saw others on several occasions on the Arghandab River and once at Kalat-i-Ghilzai in S. Afghanistan. It occurs in the Sibi Plain where it is doubtless resident.

In S. Baluchistan I only know of it in the Habb Valley where it is resident and breeds ; a nest in a rock overhanging the river found by Mr. Culbertson on July 19 held three eggs.

Hirundo daurica rufula, Temm. The European Red-rumped Swallow.

There is nothing to add to Meinertzhagen's account of this bird (Ibis, 1920, p. 167). He says it is an evenly distributed but a scarce summer visitor to the Quetta District arriving in the last week of March and breeding in May at 5,000 to 11,000 ft. Lieut Searight informs me that a pair were building in the rest house at Barkhaw (Fort Sandeman District) on March 19, 1924. It leaves in September and October. Marshall records a nest at the end of April in a culvert under a railway bridge.

Not recorded elsewhere in Baluchistan, its passage perhaps lies further west.

Motacilla alba dukhunensis, Sykes. The Indian White Wagtail.

Common throughout the whole of Baluchistan (and at Kandahar) in winter except at the highest elevations, i.e., above 6,000 ft. It arrives in the Quetta Valley at the end of September and leaves early in April. Also in the north it is of course a double passage migrant in March and October.

It arrives in the Makran in October and leaves at the end of March ; W. D. Cumming noted it at Ormarra once as early as August 14, an unusually early date.

Motacilla alba personata, Gould. The Masked Wagtail.

The Masked Wagtail is sparingly distributed in N. Baluchistan ; it is recorded in winter at Kandahar (common), at Chaman, Pishin, Quetta Valley and Sibi. It undoubtedly breeds. Meinertzhagen saw it at Khushdil throughout May and near Baliki, June 2. Swinhoe obtained it at Kandahar on June 26. D. Radcliffe found it at Ziarat in June and July, while W. D. Cumming sent for identification a half-grown young bird picked up in Quetta Cantonment.

Though it probably occurs in small numbers in Makran, the only record we have of it is from near Dizak on the Persian side where Hotson found it fairly numerous on November 4, and obtained two specimens.

Motacilla cinerea caspica (Gm.) (= *melanope*, auct.) The Grey Wagtail.

In N. Baluchistan the Grey Wagtail is a summer visitor to the mountain streams between 7,000 and 9,500 ft. arriving according to Meinertzhagen early in March and nesting in May. He found nests with four eggs on June 2, and five young on June 10.

Some at all events overwinter in the lower plains and valleys ; it has been obtained at this season at Kandahar and Kalat, and on December 12 I saw several by an open pipe line in the Quetta Valley.

Hotson noted this bird in the Makran first on September 16, at Ornach in the Hingol Valley and obtained others on the Persian side in January. It is of course a winter visitor and not common.

Motacilla flava beema, Sykes. The Indian Blue-headed Wagtail.

The Blue-headed Wagtail occurs in small numbers in the Quetta Valley on spring passage from mid-March to mid-April and it is common too at Kandahar by the end of March. It has doubtless been overlooked in autumn. St. John's record that Duke obtained a young one at Mastung in June must, I think, have been made in error.

The only record in S. Baluchistan is Cumming's statement that it occurs at Ormarra on spring and autumn passage. It doubtless occurs elsewhere at these seasons but probably does not winter there as I failed to find it at that season in Sind.

Motacilla flava thunbergi, Billberg. The Grey-headed Wagtail.

The status of this bird is not at all clear and records appear to be mostly founded on sight records. Radcliffe says it is occasionally seen at the end of March and early in April at Quetta, whence Marshall also records it and also Murray. It probably does occur as Swinhoe certainly obtained several at Kandahar on spring passage and St John's record as *cinereocapilla* no doubt refers to the same. Meinertzhagen records it on passage at Quetta in the latter half of August. There are no records of this bird in the Makran nor in Sind.

Motacilla feldegg melanogriseus (Hom.) · The Black-headed Wagtail.

The Black-headed Wagtail passes through N. Baluchistan's plains and lower valleys in spring in fair numbers. Meinertzhagen noted in the Quetta Valley from March 22 to May 5, and Swinhoe records the arrival at Kandahar as early as February 22. At Kandahar a few according to St. John remain to breed and there are specimens thence obtained on June 15. It passes through again in August and September. I have seen an immature bird obtained at Quetta on August 17, and I obtained one there on August 17, and another was obtained at Sibi on September 2.

It has been noted on the Makran coast on spring and autumn passage and on spring passage in Central Makran at which time Blanford too obtained it on the Persian side.

I cannot find the specimen (in the British Museum) recorded as *M. raii* obtained by St. John at Dubrai in April 1881, it could hardly have been this race.

Motacilla citreola citreola, Pall. The Yellow-headed Wagtail.

This is commonest Wagtail on spring passage in N. Baluchistan arriving in the middle of March and swarming early in April (Meinertzhagen) ; at this time it is recorded by Barnes as very common at Chaman and at Kandahar by Swinhoe. It has been obtained at Nushki as late as May. On autumn passage it must have been overlooked as Swinhoe got several at Kandahar ; it is recorded in autumn by Marshall.

On autumn and spring passage it is common in S. Kalat, Jhalawan and Central Makran. Cumming records it too at Ormarra at these seasons but it probably winters in suitable spots as Hotson obtained it on the Persian side and Cumming at Charbar and I have seen it in the Habb Valley in winter.

Motacilla citreola calcaratus (Hdg.) Hodgson's Yellow-headed Wagtail.

This Wagtail is chiefly a passage migrant in the north ; Meinertzhagen notes it arriving in far fewer numbers than *citreola* early in April at Quetta and Swinhoe records it as common in spring at Kandahar ; it has been obtained at Nushki in May. Here and there a few pairs breed ; Meinertzhagen found two nests with young, at Khushdil on June 20, and at Bostan on June 18, and W. D. Cumming saw young on the wing at Khushdil on June 28, 1923. A few too breed according to St. John at Kandahar. On autumn passage it must have escaped notice amongst the other Wagtails ; there is a specimen in the Quetta Museum obtained at Baleli on August 15.

There are no records elsewhere in Baluchistan.

Anthus trivialis trivialis, L. The Tree Pipit.

The Tree Pipit does not appear to be common or else it has been overlooked. Barnes recorded it for Chaman, and Radcliffe and Newnham say it is occasionally seen in the Quetta Valley in winter where in two years Meinertzhagen failed to meet with it. It certainly occurs at Kandahar in winter and spring. Murray recorded it as abundant on the plains above and below Quetta in March and April. Betham says that a few breed near Quetta and that he found two nests on June 21 with 3 eggs and with 3 young ; but in the absence of any confirmation of this, or specimens bearing this statement out, I hesitate to accept it. I obtained a migrant at Ziarat on September 29 and W. D. Cumming notes it at Sheik Mandah on September 26. I have examined specimens from the Khojak, September 14 and Kandahar, October 31 and April 2 and Quetta September 22.

Cumming has obtained it at Ormarra in Makran on September 19, otherwise there are no records in S. Baluchistan where it must surely occur here and there in winter or on passage.

Murray thought he examined the remains of a specimen of *Anthus maculatus* (= *hodgsoni*) ; he was doubtless mistaken.

Anthus sordidus decaptus, Meinertz. The Brown Pipit.

Recorded by the old writers as *A. similis* or *jerdoni*, this Pipit is common throughout N. Baluchistan from Kalat to N. E. boundary breeding in the hills at from 6,000 to 9,500 ft. In winter it wanders down to the lower valleys and plains including the Sibi Plain and I found all had left the Ziarat District by the third week in September. Nests with eggs are recorded from April 19 to July 18, so probably there is more than one brood. Four to five is the usual clutch and the nests are usually on hill slopes in the shelter of a rock or tussock.

To Coastal Makran, including Las Belas, it is a scarce winter visitor but it possibly breeds in Central Makran as it does so in Persian Baluchistan, but I have no actual records.

A series of Persian, Baluchi and Sind birds measure W. 94–105 and this I find to be the same as in *A. s. jerdoni* ; quite fresh-moulted birds are more rusty underneath than they are later in the year and approach very near to *jerdoni* while the edges to the grater wing coverts may be as brown as in *jerdoni* ; however in series *decaptus* can be differentiated.

Anthus richardi rufulus, Vieill. The Indian Pipit.

On August 17 I saw a pair of Pipits in some damp grass close to Galbraith Spinney in Quetta which were undoubtedly this species. St. John obtained it at Kandahar on June 15 where he says it is a summer visitor ;

Swinhoe too obtained it at Pishin at the end of April. It will probably be found here and there in the north in the plains and valleys and it may well occur in Las Belas but there are no records of it. Murray lists it.

Anthus campestris griseus, Nicoll. The Tawny Pipit.

St. John and Marshall both record the Tawny Pipit as common in winter in N. Baluchistan as Swinhoe does for Kandahar. Some may winter of course but all the specimens available tend to show that it is a passage migrant passing through in September and October and in March and April. In the Quetta Valley it would be seen to be rare as Meinertzhagen only met with two both in April. The spring passage would appear to last from about March 20 to April 26. I obtained one at Ziarat (in a small clearing in thick juniper forest !) on September 25.

At Nal in S. Kalat Duke obtained it on April 22 and in Coastal Makran Cumming has noted it in spring and autumn, but one would think that it must winter there. At Dizak on the Persian boundary Blanford obtained it on March 24.

I know not on what grounds this bird is listed as ' breeding ' in Baluchistan in the *Hand List of Indian Birds*. Sex for sex measurements will at once distinguish this pipit from *rufulus* ; W. ♂ 90–94, B. 17–18, ♀ 81–84, B. 16–17. *rufulus* W. ♂ 80–85, ♀ 76–80.

Anthus cervinus, Pall. The Red-throated Pipit.

The Red-throated Pipit was obtained by Blanford at Dizak, just over the border in Persian Makran on March 24. It should occur within our area as a winter visitor passage migrant but there are no records of it.

THE WATER-PIPIT

Anthus spinoletta blakistoni, Swinh.
Anthus spinoletta coutelli, Savig.

The Water-Pipit is a winter visitor to the lower valleys and plains of N. Baluchistan and Kandahar from early October to the second week in April. It is not uncommon in suitable places such as irrigated fields, ditches, etc. Both races occur and I have examined several of both races from Quetta and Kandahar.

It is found throughout Coastal Makran in winter and probably also in Central Makran ; it so happens that the western birds I have examined are *coutelli* and the eastern ones *blakistoni*.

Oreocorys sylvanus (Hodg.) The Upland Pipit.

Ball states that he shot one and saw several in the highest parts of the Sulaiman Range. It may well occur there as Whitehead records it from Samana, 4,500 feet, near Kohat. A bird however which was obtained at Quetta on September 22, and which has been recorded by Radcliffe and Meinertzhagen as this species is nothing but a Tree Pipit. It is in the Quetta Museum where I have examined it.

[Radcliffe records that he often saw Pipits at Ziarat breeding in June and July at 9,000 ft. which he thought might be *Anthus rosaceus* of which species I have no record in Baluchistan. What species it is which breeds at Ziarat is still unknown and all Pipits had gone when I was there in September.]

Alæmon alaudipes cinerea, Zar. The Large Desert Lark.

Radcliffe says this Desert Lark occurs sparingly and records one from Quetta Valley in the winter of 1911–12 where Meinertzhagen obtained one on November 3, 1913 ; he also records one from the Zhob Valley in April 1891. According to Nicol Cumming it breeds at Nushki and it had been obtained at Kandahar. It probably occurs here and there in suitable plains ; Murray records it from the Bolan Pass and Gulistan.

In Las Belas, Jhalawan, S. Kalat and throughout Coastal and Central Makran it occurs in suitable places and is resident, especially in the sand-hills and desert plains near the coast. W. D. Cumming who found several nests with 3, and once, 4 eggs between April 5 and 27 describes the nest as always being placed on a small bush or shrub.

Otocorys alpestris albigula, Bp. (=*pencillata* auct., pl.) The Horned Lark.

This Horned Lark is recorded from Kandahar by Swinhoe and St. John but so far has not been obtained within our limits though I thought I saw a flock on the top of Kitchener Hill, Quetta, on December 12. Swinhoe obtained a pair at Kandahar on January 25, 1881, in the British Museum.

Melanocorypha bimaculata. (Ménét.) The Bimaculated Lark.

Most authors state that this large Lark is a winter visitor to N. Baluchistan but there are no definite records between November 26, and March 2. I know of no record bearing out Radcliffe's suggestion that it breeds there. Swinhoe says it is a common cage bird at Kandahar and a winter visitor there. Watson must surely have meant this species when he records *M. maxima* from Chaman.

Cumming has noted this Lark as a not uncommon winter visitor to the Makran coast and Blanford too obtained it at Gwadar. Beyond the fact that Duke got it in S. Kalat I have no information concerning the rest of the Makran.

The Curator of the Quetta Museum assured me that he had examined two Calandra Larks (*M. calandra*) taken by bird-catchers amongst some Bimaculated Larks at Quetta in the winter of 1916, however as these were not preserved, I must omit them.

Alauda arvensis intermedia, Swinh. (=*dulcivox*, Brooks=*cinerea*, Ehmcke.)

The Skylark.

All records of any *arvensis* breeding in British Baluchistan are erroneous. The Skylark is a winter visitor in considerable numbers to the valleys and plains, including Kandahar, but not Sibi, from mid-November to the end of February.

It may winter in Central Makran but the only record I have comes from Magas on the Persian side. Not recorded elsewhere.

Alauda arvensis schach, Ehmcke.

Meinertzhagen has shown me two males collected by him at Quetta on October 30, 1913 and February 20, 1914 (W.118–119) which are pale sandy brown above quite unlike *intermedia*. The bird described by Ehmcke from E. Persia is said to be of this colour and so I place these birds under this name until more is known about this race.

Alauda gulgula inconspicua. Severz. The Small Turkestan Skylark.

This is the breeding Skylark of N. Baluchistan below 6,000 feet. St. John says it is resident but Swinhoe states it is a summer visitor. All the records which I have been able to gather relate to the period March 20–August 24. Meinertzhagen records nests at Khushdil on May 17, with 3 eggs and on July 11, with 3 young. I found this Lark abundant in damp grass fields and cut lucerne in the Quetta Valley in mid-August. It occurs from S. Kalat to Kandahar and from Quetta to the Bolan Pass. There are no records of it elsewhere.

I have examined 13 Baluchi-Kandahar specimens, a large series from the plains of India and a few Turkestan birds. The Baluchi birds measure W. 90–101, and the typical race 87–98. Some March birds from the plains of India are quite as pale as Turkestan and Kandahar birds though others are darker while some freshly moulted Baluchi birds are only a trifle paler than fresh moulted Indian birds. On the whole I think this is a poorly defined race which can only be said to average paler and larger than the Indian bird.

Calandrella brachydactyla longipennis (Evers.) The Short-toed Lark.

This Short-toed Lark is a winter visitor in numbers from October to March ; the earliest I have seen it was on September 24 at Khawash, near Ziarat and I obtained one at the latter place on October 3. It is also a passage migrant through N. Baluchistan.

To Central and Coastal Makran it is also a winter visitor, the latest record being April 13, in Kolwa District.

Most specimens I have examined are typical *longipennis* but in the plains of India individuals occur which are barely separable from the typical race.

Calandrella acutirostris acutirostris, Hume. Hume's Short-toed Lark.

Hume's Short-toed Lark is fairly common in the hills of N. Baluchistan but rather local; it breeds in the valleys of the hills at 6,000 to 9,000 feet throughout the Kalat and Quetta Districts. Meinertzhagen records nests between May 10, and June 8, with one and four eggs and he thinks that most of the birds leave in the winter, he has however obtained it at Chaman on February 17. It may of course have been overlooked but it has not been met with in Lower Punjab in winter nor in S. Baluchistan and is only once recorded from Upper Sind.

Calandrella raytal adamsi (Hume.) The Indus Sand Lark.

This Sand Lark is probably resident all along the Makran coast. Cumming has seen it at Ormarra and obtained it at Pasni in February while at Jask in Persian Makran he found it breeding. I have seen skins from Bundar Abbas further west still where it was said to be numerous. Unknown elsewhere in Baluchistan.

Calandrella rufescens leucophæa, Severtz. The Lesser Short-toed Lark.

Meinertzhagen has shown me a specimen of this Lesser Short-toed Lark which he obtained on November 7, at Quetta; it is a very pale grey form.

Calandrella rufescens seebohmi (Sharpe.)

Meinertzhagen identifies as this race a bird he shot from the nest at Kushdil Khan on May 17, and which he previously (*B.N.H.S. Journal*, xxiii, 362) identified as *persica*. It is not clear therefore that this last race occurs within our limits though two labelled S. Afghanistan (Griffith coll.) are in the British Museum.

Calandrella rufescens seistanica, Zar. and Loud.

Meinertzhagen informs me that he obtained a bird which he assigns to this form at Quetta on November 7, out of the same flock as the specimen of *leucophæa* above. This race appears to be very close to *seebohmi*.

It is evident that there is much yet to be learnt concerning the range and status of the Lesser Short-toed Larks in N. Baluchistan. In the Makrans there is no record of any form of it.

Mirafra erythroptera sindianus, Ticehurst. The Red-winged Bush Lark.

This Bush Lark certainly occurs in the Habb Valley where I saw it doubtless breeding in June and it may well occur in parts of Las Belas but probably not elsewhere in Makran. Some species of Bush Lark occurs in the Suleiman Hills (Fort Munro District) as Ball records that he obtained a young bird which he doubtfully identified as *cantillans* in July 1874 at 4,000 ft. in the Charmarlang Valley.

Galerida cristata magna, Hume. Hume's Crested Lark.

This Crested Lark is common and more or less resident throughout Kalat and the whole of N. E. Baluchistan below 7,500 ft. but is scarce above 6,500 ft. First nests with eggs may be found by the last week in April and the usual clutch is 4 or 5 eggs; W. D. Cumming notes however a nest with young on April 27.

This race extends, in winter at least, to the Sibi Plain and to the Makran.

This is undoubtedly the race that breeds in Kalat, Quetta District, Kandahar, and Fort Sandeman District, and probably in Central Makran.

Galerida cristata chendoola (Frankl.) Franklin's Crested Lark.

This is undoubtedly the breeding bird in the Habb Valley and Las Belas Plain. Laubmann records the birds collected by Zeugmayer in Coastal Makran as *magna?* I have examined these birds (kindly sent me by Dr. Laubmann); they are breeding birds and very worn in plumage more so than would be Sind birds at the same time of year (cf. under *Argya c. huttoni*) and are also very bad specimens but they agree fairly well with *chendoola* and have not the sandy colour of *magna*, moreover they are small for this race (5 ♂♂, W. 100–109.); on the other hand I have seen no *chendoola* from the Indian Plains with a wing quite so long as 109. Two birds collected by Hotson in February at Charbar however are certainly *chendoola* by their coloration, both labelled males they have wings of 99 and 108. It seems probably the case then that in western Coastal Makran we find the intergrading area between these two races. From Central Makran I have only seen winter birds and these are *magna*, but a bird from Dizak on the Persian boundary obtained on March 21, when it may have been breeding or still a winter visitor, is too undoubtedly *magna*.

The Crested Larks then of the Makrans present an interesting problem as to over what area and where the Indian form intergrades into the hill form of the north, and this can only be determined by more and carefully collected specimens ; but it is of considerable interest to find that so far as we know intergradation takes place in one area and is the same area where *Argya c. caudata* grades into *A. c. huttoni*.

Breeding birds from Sibi and the Bolan Pass would be of interest as here too probably intergradation takes place.

The Crested Lark has several names in Baluchistan according to the District —Chajok, Chotab, Chagul, Chirlul, Chagag and in Persian Kamalak.

Ammomanes deserti iranica, Zar. The Persian Desert Lark.
Ammomanes deserti phœnicuroides (Blyth.) The Indian Desert Lark.

' Dasht-i-Chajok ', Bal. ; ' Kompi ', Brahui.

Desert Larks are common and resident throughout the whole of Baluchistan; in the north they affect the foothills of the plains, and valleys up to 7,000 ft. but not ascending the actual hills. They breed in the first half of May.

In the Makrans it is common and occurs and breeds right down to sea-level ; here it nests earlier as Cumming noted fledged young on March 18 and again on June 14 and nest building on June 8, so, two if not three broods are reared.

These two races are very near each other ; birds from Persian Makran are topo-typical *iranica* and these are darker colder grey on the upper parts than *phœnicuroides* and tend to run rather larger ; a large series measure ♂ W. (99) 101–112, ♀, 96–101 ; *phœnicuroides* does not reach such extreme measurements, a series (Cashmere. Punjab and Sind) ♂ 99–104·5, ♀ 93 99. Under *iranica* then I would place birds from Gwader, Charbar and Persian Makran, Persian Baluchistan, E. Persia and Muscat in Arabia. Passing east, the Las Belas bird is certainly *phœnicuroides* (as is Lower Sind) but between these two areas I have seen none ; probably as in the case of the Crested Lark intergrading will be found.

Passing to the north, birds from Sibi and the Bolan Pass are *phœnicuroides* as are birds from Fort Sandeman. When we come to Quetta, Kalat and Kandahar birds, I find that many are indistinguishable in colour from *phœnicuroides* in all three localities but they tend to run a trifle larger, 7 ♂ ♂ W. 99–108, 6 ♀ ♀, 96–104. Odd birds however are not distinguishable in colour from *iranica*. The larger series which I have examined does not bear out that Quetta birds are *iranica* and Kandahar birds are *phœnicuroides* as suggested by Meinertzhagen but that here in N. E. Baluchistan too we have an intergrading between the two races.

From Central Makran I have only seen one or two moulting specimens and so cannot fix which race is found there or whether they too are intermediates.

Ammomanes phœnicura zarudnyi Hart. Hartert's Rufous-tailed Desert Lark.

This Lark must surely occur in British Baluchistan ; Zarudny obtained it at several places in Eastern Persia (which, like most of his localities, I am unable to trace on the maps) and also in the ' Mashkel Plain ' but whether on the Persian or British side of the frontier is not apparent. However as Blanford obtained it south of Sehwan in Sind it should occur right across Baluchistan.

Pyrrhulauda grisea siccata Ticehurst. The Ashy-crowned Finch-Lark.

W. D. Cumming informed me that he has seen a few pairs on plough land near Ormarra and it may well occur in Las Belas. No other record in the south. Murray records it from the Bolan Pass.

Pyrrhulauda frontalis affinis, Blyth. The Black-crowned Finch-Lark.

This Finch Lark is probably a local resident all along the Makran coast to Persian Makran. It is certainly resident in the Habb Valley; Cumming obtained it at Ormarra ; Zeugmayer near the Hingol River and near Pasni and Blanford at Bahu Kalat. No records elsewhere.

Cinnyris asiatica brevirostris (Blanf.) The Purple Sunbird.

The Sun-bird is not uncommon in the Sibi Plains and appears to ascend the Bolan Pass to Mach as a summer visitor at the end of March, and occasionally straggles to Quetta ; it is not recorded from elsewhere in N. Baluchistan.

Throughout Las Belas, Jhalawan and as far as Nal in S. Kalat the Sun-bird occurs upto 4,000 ft. and is common as it is too throughout Coastal and Central Makran in suitable places, especially in tamarisks in the valleys. Further west it extends through Persian Baluchistan as far as Bam and Bunder Abbas in E. Persia and Muscat in Arabia.

The type of *brevirostris* came from Persian Baluchistan and the few specimens I have seen from British Makran and 9 males from Mach in the Bolan do not differ from *brevirostris*, their bills measure 15–16·5 mm. (from frontal feathers) against 14–16 mm. in a series of topo types.

Cumming who found this bird nesting plentifully at Charbar noted that none of the nests had the 'porch' entrance and thought that this absence was associated with no rainfall ; I noted the same circumstance in Sind.

Picus squamatus flavirostris (Menzb.) =(*gorii*, auct.). Hargitt's Scaly-bellied Green Woodpecker.

This Woodpecker occurs in the juniper forest at Ziarat where Meinertzhagen obtained several and where I and Radcliffe have seen both birds and old nest holes. St. John records it from the Kwaja Amran and it occurs on other forested hills in N.E. Baluchistan and extends to Shinghar in the Zhob Valley and doubtless other places though I have no record of it in Kalat. It is nowhere very common and is resident moving to the lower valleys only in winter and has at this season been obtained in Quetta.

Unknown elsewhere in Baluchistan but occurs on the Helmund in Seistan.

Dryobates scindeanus (H. and M.) The Sind Pied Woodpecker.

'Gihan' Brahui ; 'Tukok' Bal. 'Burdi-tokeri', in S. Kalat.

The distribution of the Sind Pied Woodpecker is rather patchy ; it is found at Sibi but up the Bolan it is unknown and to Pishin and Quetta it is only a wanderer. However, at Shalabagh and at Chaman on either side of the Khojak and on the Kwaja Amran it is fairly common and resident. Murray records a nest without eggs on April 4 and Barnes found a nest with young in May. It occurs throughout Kalat.

In the south it occurs not uncommonly in the Las Belas Plain breeding in the *Acacia arabica*. Here and there it is not uncommon in the valleys of the Central Makran such as the Dhor, Mashkai and Nihing and occurs north to Nal in S. Kalat. Further westward its distribution can be traced into Persian Baluchistan at elevations up to 3,000 on to Bampur in Persian Baluchistan.

Baluchi birds are not different to Sind ones ; the bills vary much in size but this is individual, not geographical. It is not a bird of high elevations.

Brachypternus benghalensis dilutus, Blyth. The Sind Golden-backed Woodpecker.

Within our area this Woodpecker only occurs at Sibi where it is no doubt resident.

Lynx torquilla torquilla (L.) The Wryneck.

The Wryneck occurs in N. Baluchistan as a passage migrant only ; earliest March 10, most pass in April to mid-May and again in mid-September ; it is never common and is only recorded from the Quetta Valley, Kandahar and Loralai Districts.

For the rest of Baluchistan there is very little information, it must pass through on passage as W. D. Cumming noticed it regularly on passage at Ormarra and Charbar from mid-August to the last week of September and again in March in quite small numbers ; presumably these are oversea migrants. There are no winter records.

I agree with Meinertzhagen that the Baluchi birds (as also the Sind ones) belong to the typical race.

Coracias benghalensis benghalensis (L.) The Indian Roller.

'Kangashk' (Bal.)

The Indian Roller is resident at Sibi and at the entrance to the Bolan Pass ; it is said by Swinhoe to occasionally straggle to Quetta but no one has met with it there in recent years.

In the Mekran it is more or less resident below 3,000 feet ; avoiding hills and more desert parts it is found where trees are sufficient which means practically its distribution is that of the Date Palm. From Las Belas it can be traced as far north as Jebri in Mashkai valley (Jhalawan) but no further north. Westward it is found throughout the Makran in suitable places to Persia and beyond ; in other places where it does not breed, such as Ormarra, it is a winter visitor from August to May.

Coracias garrula semenowi, Loud and Tschusi. The Common Roller.

' Sabzkarask ' (Brahui)

The Roller arrives in N. Baluchistan early in April and becomes commoner later in the month. Nicol Cumming and Murray both record it as swarming on passage on the Khojak and on the Kwaja Amran hills but in other places it would appear to be less common. It is common too at Nushki in April. St. John recorded it as a common summer visitor to Kalat but he gives no evidence of it breeding nor does Radcliffe who found it common between Kach and Ziarat at the end of July. It returns on passage regularly at this date and I know of no evidence of it nesting within our area. Its migration extends throughout August and odd ones may occur later.

It must occur in the Mekran as a passage migrant one would think, but I have no definite record of it.

Merops orientalis beludschicus, Neumann. The Little Green Bee-eater.

Swinhoe records the Little Green Bee-eater from the Bolan Pass but not beyond Mach and it is of course common as a resident in or a summer visitor to the Sibi Plain ; it occasionally straggles into the Quetta Valley where it is recorded in November and January.

Common and resident throughout Coastal and Central Makran and so into Persian Baluchistan, to Bampur, Bunder Abbas, etc. In the Makran Hotson did not meet with it further north than Gajar in the Mashkai Valley.

Merops persicus persicus, Pall. The Persian Bee-eater.

' Haur Murgh ' (Brahui=rainbird) ' Kurru ' (Bal.)

The Persian Bee-eater is locally fairly common as a summer visitor to N. Baluchistan ; Meinertzhagen and W. D. Cumming have met with it breeding at several localities in the Quetta District, viz., Sheik Wasil, Khushdil, Saranan and Yaru, the former recording nests with 3 and 4 eggs on June 2. St. John considered it to be a common summer visitor to S. Afghanistan and Kalat and Hotson came across it in two localities in S. Kalat in the breeding season I noticed it on passage in the Sibi Plain at the end of September and early in October.

It would appear to breed here and there throughout at least the western part of Central and Coastal Mekran, definite records coming from Panjgur, Nihing Valley and Gwadar. As a passage migrant they first arrive early in April, most coming later in the month, to early May and it repasses again in the last half of August.

A young bird recorded as *Merops phillipinus* by Radcliffe which was shot at Quetta on September 1913 and went to the Quetta Museum must, I think, have been wrongly identified. There is no specimen of this bird in the museum.

Merops apiaster, L. The Common Bee-eater.

By far the commoner of the two large Bee-eaters the European bird is an abundant summer visitor to N. Baluchistan arriving throughout April (earliest 4th) and leaving by September. It nests in suitable places in the plains and valleys below 6,000 ft. between Quetta and Kandahar and east to Shingar in the Zhob Valley and all over Kalat where Hotson found it very abundant at Mastung and a great nuisance to bee-hive owners. But besides bees it preys upon wasps and hornets and Nurse records that it is the only bird which will tackle the fierce yellow wasp *Polistes hebræus*. Meinertzhagen records nest excavations on April 15 and first eggs on May 9.

South of Shiretai (Kharan) in S. Kalat (where it breeds) this Bee-eater is apparently only a passage migrant, but Hotson met with it in the Panjgur District on April 27, where it may have been on passage. It arrives in Coastal Makran in the first days of April and repasses again in August overseas.

Ceryle rudis leucomelanura, Reichen. The Pied Kingfisher

The Pied Kingfisher is resident at Sibi and only just penetrates into the hills up the Nari River where I have seen it and up into the Bolan Pass. To the Quetta Valley it appears to occasionally straggle where single birds are recorded by Duke and Marshall. Lieut. Searight informs me it is always to be found near perennial water in the Zhob and Loralai Districts. St. John says it is very rare at Kandahar.

It is common and breeds in the Habb Valley and perhaps elsewhere in Las Belas but there are no records of it west of this. There appears to be a big break in the distribution of the Pied Kingfisher ; the typical race occurs as far east as the Shiraz District where it is rare.

Alcedo atthis pallasii, Reichen. The Central Asian Kingfisher.

' Narian Shid ' (Bal.)

Although there are no records of any nests of this Kingfisher in N. Baluchistan it seems quite possible that some may breed there. At all events it is common in the valleys and plains where water is found from November to May (latest May 6) and Meinertzhagen records a bird in the hills on July 17. In the Sibi Plain it occurs in winter.

To Central Makran it is a winter visitor arriving at the end of August and on the coast at this season it is found on salt water frequenting mangrove swamps or posts about the shore. So far as is known it does not breed in the Makran but Hotson met with it in the Punjgur District on April 23.

Numerous specimens examined from Baluchistan all belong to this race and none to *bengalensis* W. 73–78, B exp., 36-42. mm.

Halcyon smyrnensis smyrnensis (L). The White-breasted Kingfisher.

' Aspi-chidok ' (Bal.) (=he who chatters at horses.)

The White-breasted Kingfisher is resident in the Sibi Plain and occurs in the lower part of the Bolan Pass. It occasionally straggles to Quetta where one has been obtained on August 2, 1908. Not recorded from Kandahar.

Coming down from Kalat Hotson did not meet with this species until he got to Gajar in the Mashkai Valley and Duke implies that above about this part it is but a wanderer. From the Sind boundary in Las Belas throughout Central and Coastal Mekran it is found locally wherever there are suitable trees, date groves, etc., and it is resident. West of our boundary its distribution can be traced right through Southern Persia to Iraq. (cf. *Ceryle rudis*).

Upupa epops epops. The European Hoopoe.

' Lachar-ghak ' (Pushtu), ' Murgh-i-Suliman ' (Bal.)

The Hoopoe is mainly a summer visitor to N. Baluchistan and is quite common and generally distributed. It arrives in March and April, Meinertzhagen records nests with eggs (maximum 5) between May 14 and June 11 and Marshall a nest with 4 young on May 18. It breeds in holes in trees and rocks between 5,000 and 9,000 feet. I found most had left the hills by the end of September, but some must winter in the lower valleys and plains as I have several records from Quetta between November and February, also at Kandahar. It winters of course in the Sibi Plain.

All through the Coastal and Central Makran it is a characteristic winter bird and is recorded at Ormarra already by August 4 but how far south it breeds is by no means determined. It of course breeds in Kalat and probably at Nal in S. Kalat and Hotson records it from Mand boundary outpost in Central Makran but there are no other records suggestive that it breeds in the Makran. On the coast line Cumming has noted it as a passage migrant in August and September and again in March and no doubt many cross the sea for the winter ; on March 23, 1918, when 20 miles from Charbar a Hoopoe came aboard my boat tired out and remained till we reached Karachi.

Baluchi Hoopoes I cannot separate from the typical race and I think Zarudny must have been mistaken in referring his Persian-Baluchi specimens to the resident Indian form. *Upupa epops loudoni* described from Baluchistan by Tschusi (Orn. Jah. 1902) is a synonym of the typical race.

Micropus melba, L. The Alpine Swift.

The Alpine Swift is a summer visitor to the hills of the Quetta District arriving according to Marshall at the end of April and early May. It has been obtained at Quetta on June 1, no doubt a wandering forager from the hills. I saw a flock of 30 birds over Quetta on August 18 apparently migrating and Meinertzhagen records migrants there in the last half of the month. No one has yet located any nesting sites. It is unrecorded in the rest of Baluchistan but has been obtained at Kandahar.

Micropus apus pekinensis (Swinh.) The Eastern Swift.

This Swift is a common summer visitor to N. Baluchistan arriving in April and breeds in cliffs and caves up to 11,000 ft, ; Marshall found nests in a cave on May 31. At Kandahar it arrives much earlier, Swinhoe first saw it on February 6 St. John speaks of it as being very common in Kalat but there are no records of it further south though one might expect that it would occur in Makran on passage ; possibly it comes in from the west.

Micropus murinus murinus (Brehm.) The Pale Brown Swift.

Though stated by Radcliffe to be common in summer in N. Baluchistan no one else has met with it there and no specimen has been obtained there, so there may be some mistake.

It occurs locally on the Mekran coast in winter but Cumming noted none between November 25 and March 10, so perhaps some leave the country altogether.

Micropus affinis galilegensis (Ant.). The Kashmir House-Swift.

The House-Swift is a local summer visitor to the hills round Quetta arriving in the last week of April ; Marshall records fresh eggs on May 17, and Meinertzhagen noted young in the nest on Murdan on June 7. St. John says ;there are small colonies here and there and it has been met with at Kandahar. Meinertzhagen obtained one on October 17, but most have gone before that date.

Beyond the fact that Hume and Blanford both met with it on the Mekran Coast in February there is no information about this bird in the rest of Baluchistan. It is recorded from Muscat but throughout its distribution it seems to be very local and there seem to be wide gaps in between the localities where it is found.

Caprimulgus mahrattensis, Sykes. Sykes' Nightjar.

'Shapkor' (Bal.)

This Nightjar is only known from the Sibi Plain where I saw several and obtained one on October 8. It is probably common there. It is recorded by Finn from S. Afghanistan in the reports on the 1896 Boundary Expedition but not as yet elsewhere in N. Baluchistan.

Throughout Coastal and Central Makran it is probably not uncommon. Hotson obtained it in the Buleda (1,650 ft.) and Turbat districts (1,000 ft.) in March and December and I have seen eggs in Ludlow's collection from Las Belas· Blanford obtained it at Bahu Kalat. A desert bird of no great elevations, it is said to be the only Nightjar of Seistan and very common there.

Caprimulgns europæus unwini, Hume. Hume's Nightjar.

A local summer visitor to N. Baluchistan and not uncommon in suitable places. This Nightjar arrives in April (earliest April 6). It is said to be common on the Khojak along wooded streams and St. John records it as common in Kalat where Hotson too met with it in the breeding season ; it is found on many of the hills in the Quetta-Ziarat District from 5,000–9,000 ft. Meinertzhagen records nests with eggs from May 6 to 28. Single birds linger late (one obtained at Quetta on October 11) but most depart in the last half of August.

It must breed in Central Mekran where Hotson obtained it in the nesting time at Chattuki sixty miles from Panjgur and Zeugmayer noted it at the latter place on July 27. Further south and on the Mekran coast it is only known as a passage migrant in spring and autumn.

Caprimulgus europæus plumipes was obtained by St. John at Kandahar on May 8, but so far has not been detected in Baluchistan. *C. ægyptius* does not occur nearer than Bampur in Persian Baluchistan.

Cuculus canorus. The Cuckoo.

The Cuckoo is a common summer visitor to and a passage migrant through N. Baluchistan ; the earliest record is March 27 but most arrive during April but Swinhoe records many females at Quetta from May 5 to 15, possibly on migration ; but during May Cuckoos leave the valleys for the hills where they breed up to 10,000 ft. Meinertzhagen records *Saxicola caprata* and *Anthus sordidus* as fosterers while Radcliffe thought that the Buntings (*E. stewarti ?*) were imposed upon at Ziarat. Williams records *Rhodospiza obsoleta* and *Scotocerca inquieta striata* as fosterers.

The status in the Mekrans is not clear ; Blanford heard Cuckoos calling in February and March in the Mekran hills bordering the Nihing river, the first as early as February 18 and Mr. Wilson of the I. E. T. informed me he has heard it at Turbat on March 14. I do not think it is likely that it breeds in Makran and there is no certainty that it winters there. At Ormarra Cumming has only noted it on passage on May 4 and October 11.

There may be more than one race of Cuckoo in Baluchistan and it is possible the race that breeds is not the same as the race which passes through to breed in countries further north. I have only seen two, a male from Iskulko on May 26, W 222 and a female Quetta May 6, W 194. Neither are with certainty breeding birds, both are very pale, finely barred and small and quite different to the birds which breed in N. W. Himalayas. Such similar birds I have seen from Persia breeding and from Iraq and Kurdistan on passage and these seem to correspond well with Zarudny's *subtelephonus* since they are smaller than *telephonus* and paler. One requires further specimens from Baluchistan to solve this difficult question.

Toccacua leschenaulti sirkee (Gray.) The Sirkeer Cuckoo.

Blanford obtained one in winter in the Habb Valley on the Sind-Baluchi boundary. It must have been a straggler, I think, as it is only a rarity or very local in the best wooded parts of Sind.

Centropus sinensis sinensis (Stephen.) The Chinese Crow Pheasant.

There is a specimen from Jhatpat in the Sibi Plain in the Quetta Museum ; it is common at Jacobabad on the frontier and may well occur at places like Jhatpat where there is some cultivation and tamarisk but it is not likely to occur elsewhere in Baluchistan.

Psittacula torquata (Bodd.). The Rose-ringed Paroquet.

Resident at Jhatpat and probably elsewhere in the Sibi Plain this Paroquet wanders irregularly up as far as Quetta whence it has been recorded in most months of the year. Even at Sibi I failed to see it so that it presumably is not common there. Single birds at Quetta may of course be escapes but on several occasions small parties have been noted and so far there is no record of it breeding there. Moreover a flock was seen by Sir Henry McMahon at Ziarat (8,500 ft.) on September 1, which could hardly have been even the progeny of escapes.

That this bird had extended its range into Las Belas from Sind was discovered by that intrepid explorer Masson early in the forties of last century and he found it also up the Porali, at the foot hills at the head of the river. It is still common and resident in Las Belas, but has not penetrated any further north or west so far as we know.

(*To be continued*)

INDIAN DRAGONFLIES

BY

LT.-COL. F. C. FRASER, I.M.S., F.E.S.

Part XXVI

(*With 3 text-figures*)

(*Continued from page 747 of Vol. XXXI*)

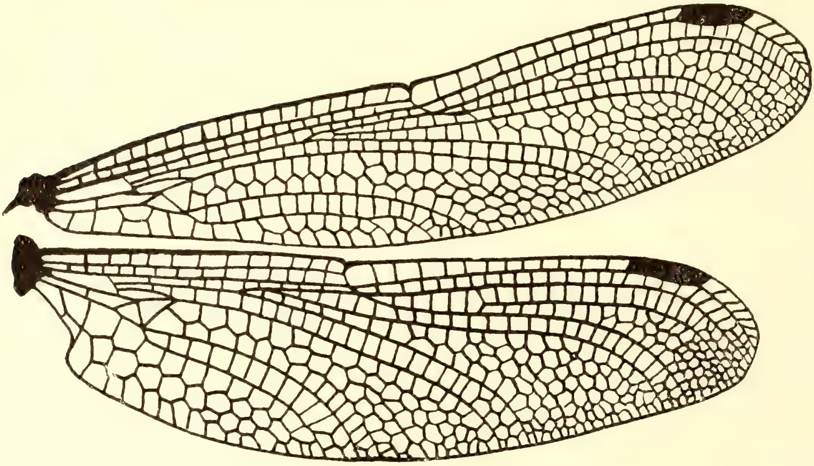

Fig. 1. Wings of *Leptogomphus gestroi*, Selys, male.

Genus—LEPTOGOMPHUS, Selys.

Leptogomphus, Selys, Bull. Acad. Belg. (11), xlvi, p. 442 (1878) ; Will. Proc. U. S. Nat. Hist. Mus., p. 291 (1908) ; Laidl. Rec. Ind. Mus., p. 378 (1922).

A genus of medium sized Gomphine dragonflies coloured black, vividly marked with citron or greenish yellow.

Wings long, moderately broad ; reticulation close ; base of hindwing rather narrow, deeply excavate ; tornus acute or right-angled ; a basal incomplete antenodal nervure present in all wings ; arc opposite the 2nd antenodal or between the 2nd and 3rd ; sectors of arc closely apposed at origin, then divergent ; 1 or 2 rows of postanal cells in forewings, usually 3, rarely 4 in the hind ; the first postanal cell in hindwing entire and extending a little more than halfway along the base of subtrigone ; 1 or 2 cubital nervures in all wings ; trigones, hypertrigones and subtrigones all entire ; trigone of forewing subequilateral, the distal side slightly longer than the other two ; in the hindwing, the costal side much longer than base, and distal slightly longer than costal ; 2 rows of discoidal cells in forewings to the level of, or a little distad of inner end of bridge ; *Cuii* pectinate in forewing (at its outer end only) ; *Cui* and *Cuii* in hindwing parallel as far as termen ; *Mia* variable, 1 or 2 rows between it and *Mi* at level of outer end of pterostigma ; pterostigma short, rather swollen, shorter than one-fourth the distance between node and outer end of pterostigma, unbraced ; 4 to 6 transverse nervures between *Mi-iii* and *Miv* in forewing, 3 to 4 in the hind.

Head triangular, rather wide, frons rounded, depressed, face very oblique. Thorax moderately robust ; abdomen tumid at base and less so at segments 8 to 10, cylindrical between these two points ; oreillets prominent.

Legs moderately long, hind femora extending to about the middle of segment 2 and armed with a row of short, closely-set spines, which in the female are fewer in number, less closely set and more robust.

Genitalia. Lamina depressed, arched ; anterior and posterior hamules robust, especially the latter, projecting prominently as broad pointed organs, variable in the species ; lobe tumid, prominent, its border usually notched.

Vulvar scale moderately long, triangular, slightly bifid at apex.

Distribution. Species of the genus are so rare, that I have been able to study only both sexes of *L. gestroi*, Selys, and *L. lansbergei*, Selys. Thirteen species have been described, one or two of which doubtfully belong to the genus, and of which only three occur within Indian limits. *L. gestroi*, *inclitus* and *maculivertex* have all been reported from Burma, the latter however is probably not a *Leptogomphus*. *L. semperi*, Selys is from the Philippines, *L. sauteri*, Ris., from Formosa, *L. perforatus*, Ris., from China, *L. lansbergei*, Selys., from Java and Sumatra, *L. assimilis*, Krug., from Sumatra, *L. gracilis*, Krug., from the same island, *L. kelantanensis*, Laid., from the F.M.S. and *L. williamsoni*, Laid, from Borneo.

Genotype—*L. semperi*, Selys.

Leptogomphus inclitus, Selys, l.c. p. 144 (1878) ; Will. l.c. pp. 291–294 (1908) Laid. l.c. p. 378 (1922).

Female. (Male unknown.) Abdomen 36 mm. Hindwing 32–35 mm. Head : labium yellow ; labrum greenish yellow bordered anteriorly with black ; face black, the centre of postclypeus yellow ; crest of frons yellow, invaded at its middle from behind by black or actually cut in two by this meeting the black on front of frons ; vertex and occiput black, the latter concave, a ridge on each side near the eyes, the area between these depressed. Behind eyes tumid, black above, yellow below.

Prothorax black with a middorsal geminate spot of yellow and a larger spot on each side.

Thorax black in front as far as first lateral suture, marked with a narrow antehumeral stripe which may or may not be confluent with a narrow mesothoracic collar. In the former case forming inverted letters ' 7 '. External to these, an equally narrow humeral stripe. Laterally yellow, the 2nd lateral suture mapped out in black and confluent with an upper black bordering below the wings.

Wings hyaline, reticulation black, close ; pterostigma brown between black nervures, over 4–5 cells, 3·5 mm. in length ; 14–19 antenodal nervures in forewings, 9–11 postnodals.

Legs short, 6·5 mm. in length as to femora, black, the inner sides of anterior two pairs and the greater part of inner sides of hind pair yellow.

Abdomen black marked with yellow as follows :—A narrow yellow stripe running along the middorsal carina from segment 1–7, broad on segments 1 and 2, tapering on 3. A lateral stripe on the same segments, broad from segment 1 to base of 3, broken into an elongate basal spot and an elongate subapical rounded spot on 3 to 7, vestigial in character on segments 5–7. Remaining segments unmarked.

Anal appendages short, conical, pale yellow, the apices ferruginous, separated by a conical structure as long as themselves.

Vulvar scale moderately narrow, extending to the middle of segment 9, bifid at apex.

Distribution. Burma. Type in the Maclachlan collection from Moolai, Lower Burma, collected by Prof. Wood-Mason. This specimen shows a greater melanism than two other females from Upper Burma, which may possibly belong to a distinct species. The species bears a close resemblance to *L. semperi* from the Philippines, a comparison with which serves to place it in genus *Leptogomphus*.

It is to be hoped that someone of our entomological members in Burma will rediscover this interesting insect, an examination of the male being necessary to settle its identity with the genus.

Leptogomphus gestroi, Selys. (*Odonates des Birmanie*) Ann. Mus. Civ. Genov. xxx (1890) ; Will. l.c. pp. 291, 294 (1908) ; Laid. l.c. p. 378 (1922).

Male. Abdomen 40–42 mm. Hindwing 32–35 mm.

Head. Labium pale yellow, the middle lobe bordered, with black ; labrum palest yellow, almost white, its base very narrowly, its anterior border broadly black, the yellow area almost bisected by a fine black medial line and a lower brownish fusiform spot. Bases of mandibles yellowish white ; ante- and post-clypeus black ; frons pale greenish yellow above and overlapping crest, its base very finely black ; vertex and occiput black but latter with a small median point of yellow, emarginate behind especially at its middle. Behind eyes yellow except the upper border.

Prothorax black, a medial spot of yellow on the posterior lobe confluent with a larger paler yellow spot on dorsum of median lobe, lastly a large outer lateral spot on each side.

Thorax black marked with yellow as follows :—A pair of antehumeral stripes running parallel with the middorsal carina, not confluent with the mesothoracic collar below but extending nearly to the alar sinus above ; a long curved, very narrow humeral stripe, its upper end slightly expanded. The mesothoracic collar very narrowly interrupted. Laterally yellow, the humeral black slightly overlapping the humeral suture, the first lateral suture and the upper part of the second mapped out in black.

Legs black, anterior pair of femora yellow on inner sides, hind femora with an outer yellow stripe, which fades away distad. The same femora armed with two rows of robust short spines, the inner row moderately widely-spaced, more robust and less numerous than the outer row, which ends in a single larger distal spine. Middle and anterior pairs with fewer but more robust spines.

Wings hyaline ; pterostigma dark brown between black nervures, over 3–4 cells, unbraced ; anal triangle 3-celled ; 3 rows of postanal cells in hindwings ; a basal incomplete antenodal nervure in all wings ; nodal index $\frac{11\text{–}14}{10\text{–}10}\Big|\frac{16\text{–}10}{11\text{–}11}$; 5 cross nervures in forewings between *Mi-iii* and *Miv*.

Abdomen black marked with greenish yellow as follows :—A small dorsal spot and the sides broadly of segment 1, a trilobed dorsal stripe and the sides broadly on 2, the middorsal carina of segments 3 to 7 finely, a baso-lateral spot followed by a medio-lateral spot on segment 3, smaller baso-lateral spots on 4 and 5, remaining segments unmarked. The abdomen from the apex of segment 7 gradually and progressively broadens as far as the apical border of 10, which latter is rather massively square, its dorsum dome-shaped, its apical border prolonged squarely between the anal appendages.

Anal appendages. Superiors bright yellow, darker below and at the inner and outer ends of base, which latter is outwardly and downwardly prolonged as a broad robust spine. Broad at base, rapidly tapering to a fine point. Beneath, and to its outer side, about 8–10 small but prominent spines. These appendages shaped like a barbed arrow-head and widely separated from each other. Inferior appendage black, very deeply and narrowly cleft, the two branches, thus formed, curling very slightly in to enclose a large segment of a small circle. Superior appendages slightly longer than segment 10, the inferior considerably shorter and strongly curled up as seen in profile.

Genitalia prominent ; lamina arched, very depressed ; anterior hamules broad at base and nearly as far as apex, directed straight out, the borders inwardly curled, the apex ungulate and recurved at an obtuse angle ; posterior hamules much larger, also directed straight out, tongue-shaped, sinuous, the apex ending in a forwardly directed, very robust curled thick spine ; lobe tumid, prominent, its anterior border deeply but narrowly notched.

Female very similar to the male but slightly larger and more robust, differs as follows :—Occiput with a broad rounded notch at its centre, on each side of which is a robust black spine.

Anal appendages short, conical, pointed, yellow, separated by a conical yellow protuberance.

Vulvar scale broad at base, tapering as far as apex of ninth segment, its apical half split into two slightly separated lamellæ.

Habitat. Burma. The type, a male in the Selysian collection, is from Leito, and was taken towards the end of May, by Mr. Fea. There is a female in the same collection, the only specimen of that sex known.

Col. F. Wall. I.M.S., has taken a second male at Maymyo, Upper Burma 1, vii. 25. It differs from type by possessing an occiput almost exactly similar to that of the female as described by Selys. The Selysian male appears to be more teneral than the Maymyo one, the markings of which are pale greenish white to greenish yellow on the thorax. This species is closely related to *L. lansbergei*, Selys., from Java, the female only of which has been described. Recently I have seen a male of this latter species, so take the opportunity of describing it, enclosing the name in brackets to differentiate it from Indian forms.

[**Leptogomphus lansbergei,** Selys. Bull. Acad. Belg. (2) xlvi, p. 446 (1878); Will. 1. c pp. 291–293 (1908) ; Laid. 1. c. p. 378 (1922)].

Male. Abdomen 44 mm. Hindwing 34 mm.

Head. Labium yellow, midlobe dark brown ; labrum glossy black with two small bright citron yellow basal spots well separated ; bases of mandibles citron yellow ; ante-and post-clypeus matt black, as also the frons in front. Whole of upper surface of head matt black save for a bright citron yellow transverse stripe on crest of frons broadly interrupted at its middle : occiput shallowly concave, depressed, at its middle two tiny spines lying close together.

Prothorax black marked with bright citron yellow as follows :—A small medial spot on posterior lobe, a large geminate spot just in front of it, a very large triangular spot on each side, below which is a smaller rounded spot. Lastly a narrow anterior collar almost confluent with the larger lateral spot.

Thorax black marked with citron yellow as follows :—A pair of antehumeral narrow stripes, slightly divergent below and not meeting the mesothoracic collar which is broadly broken at its centre. A narrow humeral stripe expanded above and again thickening below, curved convexly outward. Laterally the two sutures broadly mapped out in black so that one sees three black stripes alternating with yellow ones.

Legs black, hind femora extending as far as middle of segment 2, armed with 2 rows of very closely-set robust spines, with a single longer distal spine at the end.

Wings hyaline, reticulation close ; nodal index $\frac{13\text{–}18}{14\text{–}12}\Big|\frac{18\text{–}13}{12\text{–}13}$; a basal incomplete antenodal nervure in all wings ; 5 transverse nervures between *Mi-iii* and *Miv* in forewings, 3 in the hind ; 1 cubital nervure in all wings ; anal triangle 3-celled ; 3 rows of postanal cells in the hindwings ; pterostigma brown between black nervures, covers 4–6 cells.

Abdomen black, shaped exactly as in *gestroi*, marked with citron yellow as follows :—A small quadrate dorsal spot and the whole of the sides of segment 1, a narrow trilobed linear middorsal stripe on segment 2, the oreillets and a broad latero-apical spot continued narrowly along ventral border towards the base, segment 3 with the middorsal carina finely and a baso-lateral triangular spot, the basal part of the middorsal carina on segment 4, the remainder unmarked.

Anal appendages. Superiors nearly as long as segment 10, closely similar to those of *gestroi* in shape, citron yellow above, brownish at apex and below, broad at base, the outer part of which is prolonged as a robust obtuse spine, not as evident as in *gestroi*. Armed beneath with a series of small spines as in that species. The apex acutely pointed, but on its inner side and slightly below is an angular projection, so that the appendage viewed from within appears to be abruptly bevelled off into a spine. Inferior appendage glossy black, differing markedly from that of *gestroi*, deeply and broadly cleft into two long branches with blunt apices, which project laterally and beyond the apices of the superiors.

Genitalia scarcely differing from that of *gestroi*, the anterior hamules relatively larger, the posterior relatively shorter and not so curled at their apices ; lobe rounded, less prominent, deeply but very narrowly fissured.

Distribution. Java. A single male in my own collection. Its close resemblance, in all features, to the female of *lansbergai*, as described by Selys, is apparent, its venation definitely places it as a true *Leptogomphus*. The discovery of this male places Kruger's *assimilis*, from the same country, as a definite species.

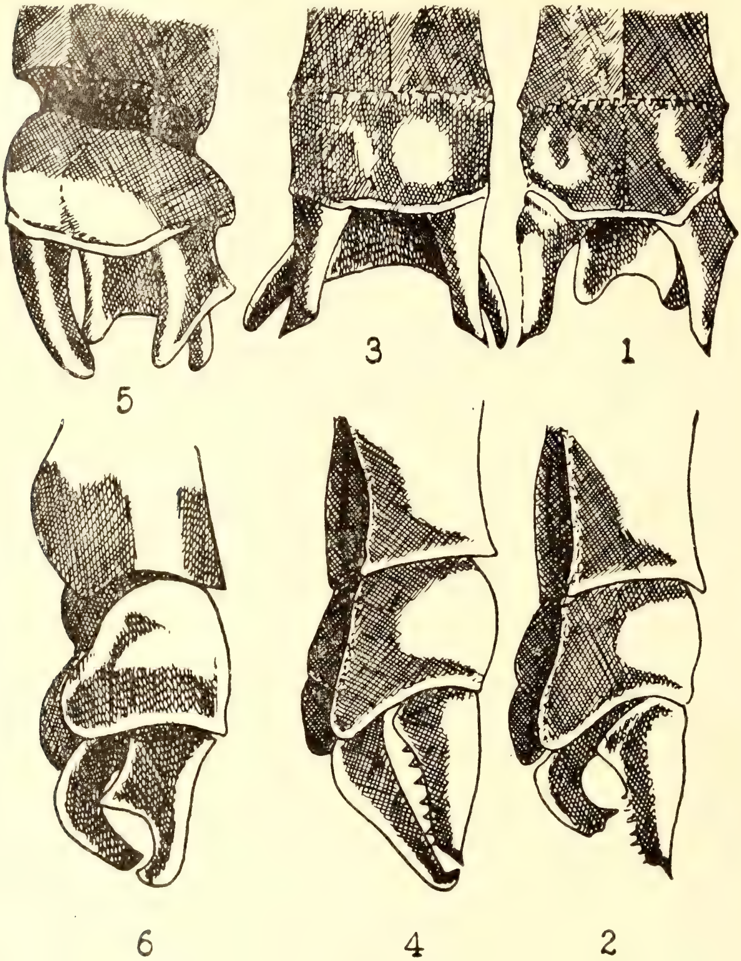

Fig. 2.

Fig 2.—1. Anal appendages of *Leptogomphus gestroi*, Selys, seen from above. 2. The same seen in profile. 3. The same of *Leptogomphus lansbergei*, Selys, seen from above. 4. The same seen from the side. 5. Anal appendages of *Sieboldius nigricolor*, Fras., seen from above. 6. The same seen in profile.

Leptogomphus ? maculivertex, Selys (*Odonates des Birmanie*) l.c. (1890); Will. l.c. pp. 292, 293 and 295 (1908); Laid. l.c. p. 378 (1922).

Female. (Male unknown) Abdomen 33 mm. Hindwing 31 mm.

Head. Labium, black its base broadly yellow; anteclypeus black, postclypeus black with a rounded spot on each side bordering the eyes; crest of frons yellow, this colour slightly overlapping the anterior surface, and invaded behind by the black of base of frons.

The occiput and a medial spot on vertex yellow, the former black behind, slightly emerginate, and with a convex scallop at its middle.

Prothorax black, its dorsum and the posterior lobe yellow.

Thorax black as far as the humeral suture, marked with yellow as follows :— A slightly interrupted mesothoracic collar, narrow antehumeral stripes which form inverted figures '7' by confluence with the collar below, a fine humeral stripe on each side, broken up into an upper spot and a lower fine line. The middorsal carina bears a small medial spot. Laterally yellow with the upper part of the first lateral suture, and the whole of the second mapped out in black.

Wings hyaline, reticulation black, close; pterostigma dark brown, over 4 to 5 cells, 3 mm. in length; 15 antenodal nervures and 12 postnodals in forewings; *basal incomplete antenodal nervure absent.*

Legs black, femora yellow marked with an outer black stripe and armed with black spines, which are moderately robust, short, and numerous. Hind femora 5 mm. in length.

Abdomen slender, the borders of segments 8 and 9 slightly dilated, black marked with yellow as follows:—A triangular dorsal spot on segment 1, a trilobed middorsal stripe on 2, the sides of these two segments broadly yellow. Segments 3 to 7 with the middorsal carina finely but not quite extending to the apical borders of segments 3 to 6, and occupying only the basal two-thirds of 7; the dorsal stripes on segments 3 to 6 lobed by an encroachment of the black at the jugal sutures, remainder unmarked.

Anal appendages slender, cylindrical, pointed, rather longer than segment 10, separated by a conical yellow protuberance.

Vulvar scale robust, yellow at base, tapering, narrow, extending to the apical border of segment 10, deeply bifid into two closely apposed lamellæ.

Distribution. A single female only of this species is known, which comes from Meteleo, Burma, collected by Mr. Fea, September 10, and now in the Selysian collection. I have not seen this type, a better knowledge of the venation of which, is needed to place it correctly.

The absence of the incomplete basal nervure suggests that it is rather a *Heliogomphus* than a *Leptogomphus*. The very long vulvar scale is analogous to that of *Gomphus nilgiricus* and *Onychogomphus M-flavum*. The discovery of the male is necessary to settle its identity.

Genus—SIEBOLDIUS, Selys.

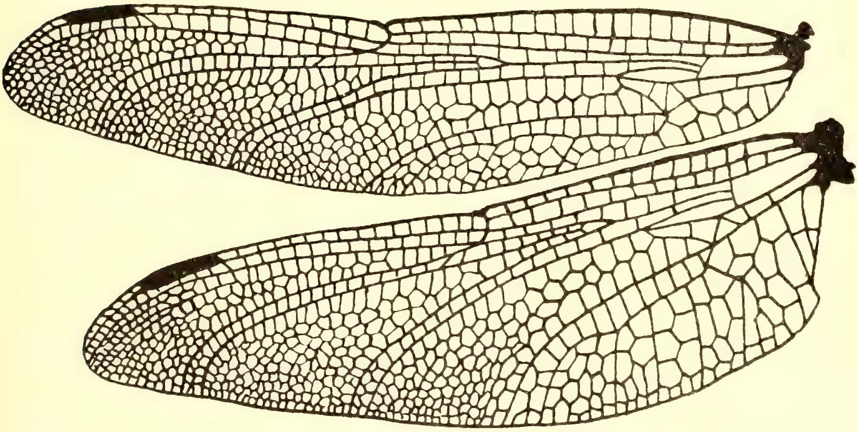

Fig. 3.—Wings of *Sieboldius nigricolor*, Fras., male.

Genus *Sieboldius*, Selys, *Syn. des Gomphines*, Bull. Acad. Belg. (1), xxi. (1854); Id. *Mon. Gomphinæ*, Mem. cour. Soc. Roy. Sci. Liege, xi. (1857); Will. l.c. p. 285 (1908); Laid. l.c., p. 372 (1922).

A small genus of very large, very robust dragonflies of sombre colouring. Wings broad and long, reticulation very close, base of hindwing oblique, shallowly notched, the tornus obtuse; anal triangle 3 to 6 celled; primary antenodals the 1st, 7th, 8th or 9th; trigones traversed once in all wings, very similarly shaped in fore and hindwings, the distal side angulated and longer than the costal, the base much shorter than either, a supplementary nervure springing from the angulation of the distal side ; hypertrigones and subtrigones entire ; 2–3 cubital nervures in all wings ; a basal imcomplete antenodal nervure present in all wings ; arc between the 1st and 2nd or 2nd and 3rd antenodals, its sectors parallel for some distance ; 2 rows of postanal cells in forewing, 5–7 in the hind, the first postanal cell in hindwing split into 3 or 4 cells and forming a distinct but rudimentary loop ; *Cui* and *Cuii* in forewing nearly parallel as far as termen, the former markedly pectinate ; *Cuii* in hindwing with 4 to 5 sectors running parallel with *Ai ;* 2 rows of discoidal cells in forewing to about level of inner end of bridge. All main sectors, especially *Mii, Rs*, *Miii* and *Miv* curving sharply towards the termen ; pterostigma comparatively short, over 6–7 cells ; *Mia* beginning nearer the node than pterostigma.

Head comparatively small and disproportionate to rest of body, triangular, frons not prominent, occiput raised into a characteristic subquadrate plate, notched at its middle and fringed with short hairs. Thorax bulky, very robust ; legs of great length, hind femora extending nearly to the apical end of segment two, and furnished with a row of closely-set spines, which become more widely-spaced and longer towards the distal end of femora. Tibial spines of the same pair of legs, very closely-set, thick and robust, relatively short. Mid-femora with very similar armature. Hooks of tarsal claws very minute, situated at middle of claws.

Abdomen long and cylindrical, tumid at base ; 10th segment markedly dome-shaped, tumid and quadrate. Anal appendages short, robust.

Superiors variable in the species, tapered, furnished with ventral spines ; inferior shallowly but broadly notched, hollowed out above, its outer ends bluntly pointed branches, curling strongly up as seen in profile.

Genitalia. Lamina prominent, sloping anteriorly ; anterior hamules short thin stillettes ; posterior hamules broad, robust ending in a short acutely pointed recurved hook ; lobe very large tumid, scrotal-shaped.

Distribution. China, Sumatra, Tonkin, Siam and Burma. *Sieboldius albardæ*, Selys, is from Pekin, *S. grandis*, Krug., from Sumatra, *S. gigas* (*Hagenius gigas*) Mart., is from Tonkin, *S. japponicus,* Selys, from Siam and Malaysia, whilst *S. nigricolor*, Fras., comes from the Chin Hills, Burma. Very little separates the two genera *Hagenius* and *Sieboldius*, hence both *gigas* and *nigricolor* were first described as belonging to the former. Williamson has pointed out the differences as follows :—*Hagenius* comes from America, *Sieboldius* from S. Asia. The former has no incomplete antenodal nervures, the median sectors curve very leisurely towards the termen, *Mia* begins nearer the pterostigma than the node, and lastly one may add that the primary antenodal nervures in forewings are the 1st and 6th. On the other hand, the shape of the 10th abdominal segment, the anal appendages and the genitalia are strikingly similar.

Sieblodius nigricolor (Fras.) (*Hagenius nigricolor*), Mem. of Pusa, Ent. Series. vol. viii, No. 8, pp. 78–79 (1924).

Male. (Female unknown). Hindwing 49 mm. Abdomen 54 mm.

Head glossy black, the upper surface of frons bright greenish yellow, except its base which is very narrowly black ; eyes probably bottle green during life. Occiput projecting squarely back as a thick plate which overhangs the prothorax, its hinder border slightly notched at its middle and densely fringed with short stiff black hairs, its upper surface coarsely corrugated and a little hollowed out ; vesicle raised into two robust points very much as in the *Libellulinæ*.

Prothorax matt black, with two small yellow points on middorsum.

Thorax black marked with yellow as follows :—A complete mesothoracic collar, which is confluent with a median spot on the lower half of the middorsal carina ; narrow antehumeral stripes not confluent with the mesothoracic collar, divergent in front, the upper ends turning out at a little more than a right angle. No humeral stripe. Laterally two oblique yellow stripes, a narrow one bordering the hinder border of the humeral suture and a broad one covering the greater part of the metepimeron.

Legs black, armed as for genus. Wings hyaline, pterostigma black, braced, 6 mm. in length ; costa finely yellow ; membrane nearly obsolete ; 3 rows of cells between *Mi* and *Mia* at level of distal end of pterostigma; 2 cubital nervures in all wings; 2 rows of postanal cells in forewing, 5 in the hind; nodal index $\frac{13\text{–}18}{14\text{–}14}\Big|\frac{20\text{–}12}{13\text{–}15}$; anal triangle 3-celled.

Abdomen black marked with yellow as follows:—The sides of segments 1 and 2 broadly, this colour extending up along apical margin as far as dorsum on segment 2, a fine obscure middorsal carinal line on segments 2 and 3, the latter with the basal part of sides yellow, segments 4 to 7 with basal paired lunules separated by the dorsal crest, 8 with its basal half yellow and rather more than that of its sides, 9 with a small baso-lateral spot, 10 unmarked.

Anal appendages black. Superiors barely longer than segment 10, broad and of even width for rather less than the basal half, then abruptly tapering to a point and converging gradually towards one another. A robust ventral spine directed slightly inwards at the level where they begin to taper. Inferior curling upward, quadrate, the outer corners produced as short robust blunt branches directed up and a little out.

Genitalia, lamina depressed, deeply and very narrowly cleft at the middle; anterior hamules thin stilettes directed backwards and downwards, converging towards each other, their apices curled a little outwards; posterior hamules very broad, long, robust, the apices quadrate, a robust hook, shaped like a tiger's claw, springing from the outer corner; lobe enormously inflated, rounded, glossy black.

Distribution. A single male from the Southern Shan States, Burma, September 23, 1923, coll. Captain Drummond.

In this Part I conclude the sub-order *Anisoptera*, which includes roughly about half of the Indian dragonflies. It has taken nearly nine years to complete and as was to be expected over such a long space of time, a great mass of material has been collected, containing many new species, some of which belong to the genera first described. The earlier part of this monograph has therefore become more or less out of date and will need revision. The inclusion of many new species will entail an extensive alteration of the keys. The descriptions of these new species will be found in this Journal, the Records of the Indian Museum, and the Memoirs of Pusa. The primary intention of this monograph was to stimulate interest in the collecting of Indian dragonflies and to add to our knowledge of a little known group. That the Journal has been able to effect this is amply shown by the fact that the total number of known species in India has since been more than doubled. We are especially indebted to Messrs. Bainbrigge Fletcher, Chas. M. Inglis, Col. F. Wall, H. V. O'Donel, T. N. Hearsey, Major Frere, J. Elton Bott, C. Souter, I.C.S. and C. Stoney, all of whom have not only collected largely but sent in valuable notes without which much of the monograph could not have been written.

(*To be continued*)

THE MASON WASP (*EUMENES CONICA*)

BY

MAJOR R. W. G. HINGSTON, I.M.S.

(*Continued from page 761 of this Volume*)

PART III

EXPERIMENTS

The illustrious observer, M. Fabre, made a series of experiments on *Chalicodoma sicula*, a mason-bee which nested under his roof. The object in view was a psychological investigation. Does the mason work blindly under subjection, or can she modify her behaviour at will ? In other words, is instinct or reason her guide ? The observer reached a clear conclusion. He found the *Chalicodoma* to be little more than an automaton. It can cope with just the simplest emergencies, but is unable to turn from the ordinary course. If, for example, it is building, then it can make a slight repair. If, on the other hand, it is collecting provender, then it can do no architectural work. Routine enslaves it. It cannot break away from the duties of the moment. It must keep to the established rhythm. M. Fabre will not grant it an inkling of intelligence. 'O little gleams of reason that are said to enlighten the animal, you are very near the darkness, you are naught.'

Here is an opportunity to test this. I examined the mason on all possible occasions. The result surprised me. I am satisfied that she is no thoughtless automaton. She is possessed of a far higher mentality than the *Chalicodoma* of M. Fabre.

Our experiments will fall into two classes. First, those indicating the intensity of instinct; second, those which prove intelligence.

EXPERIMENTS ON INSTINCT

We will compare our mason with the *Chalicodoma*. The latter constructs an earthen cell, stores it with honey, lays an egg, then closes the gate. But her activities alternate. First she builds to a certain height, then gathers some provender, then resumes the architectural task. Thus she varies the nature of her business, being at one time a mason, at another a provisioner during alternate stages in the work.

While the *Chalicodoma* was building M. Fabre made a hole in her cell. The insect quickly repaired the damage. A simple feat, scarcely beyond instinctive routine. The wasp at the time was employed at masonry. The repair then was a mere continuation of building, the clay being applied to the breach instead of to the edge of the wall.

Experiment 1.—Now turn to the cone-shaped mason. While she is collecting clay I break a hole in the side of her cell. It is a gaping rent. Through it she might thrust her head, or a caterpillar might fall out from the inside. The wasp on her return resumes architecture. She continues to apply pellet after pellet, raises her wall to the very summit, lays an egg inside. But she never pays the slightest attention to the breach, makes no attempt at repair.

Remember our egg-laying experiment. In that case the breach was in the egg-attaching area. The wasp was driven to the greatest perplexity. She was enduring a painful strain, having nowhere to attach her egg. Yet even this did not impel repair. A pellet or two might have solved the difficulties. But she never seemed to think of this simple solution. On the contrary her egg was shot into the air. We might conclude that she was even more of an automaton than even the *Chalicodoma* of M. Fabre.

Experiment 2.—Let us continue. To solve the problem of instinct and reason we must employ every test. A cell is built, an egg laid, the mason is on the hunt. During her absence I amputate the rim. I remove that elegant support which she fashions for securing the plug. She returns. Only a visit of inspection however. There is nothing in her jaws. The inspection proceeds. Her antennæ enter the gate, investigate its shape and width, then test the edge all round. It is a rapid, yet thorough survey. Moreover it is prolonged. Clearly it discloses something abnormal. Perhaps she appreciates the loss of the rim. Off she goes. I anticipate that she will bring materials for repair. A wrong supposition. Her burden is a caterpillar, not a pellet. More are brought. She stuffs the cell full, again tests the amputated aperture, finally introduces a plug into a rimless hole.

Again we see agreement with the *Chalicodoma*. Provisions were being collected ; the work of building had been done. She could not go back to it. The machine had advanced so far that the mason could not retrace her work.

Experiment 3.—Here is another confirmation. The wasp is collecting caterpillars. I cut a square from one side of the gate. The size of the opening is doubled ; its shape is completely changed. Size and shape, what are these to the mason ? We have seen her geometrical capacity, measuring distances, shaping a circle from an ellipse. But see her futility in this emergency. Her measuring powers are useless. She is oblivious to all geometry. Nothing but storage occupies her mind. All she does is to bring caterpillar after caterpillar. No repair is attempted. At length storage finishes. Then she builds up both the natural aperture and my artificial square.

Again we reach the same conclusion. The wasp will have nothing to do with masonry when employed in collecting supplies.

Experiment 4.—While the mason is touching up the cover, I pull out the plug. Here we see a better behaviour. The mason brings a fresh plug. This makes her equal to the *Chalicodoma*, which, when working at masonry, repaired the breach. But there is no intelligence. It is scarcely more than instinct. Cover-making is the time at which to search for imperfections. The absence of a plug is an obvious imperfection. Hence it is restored.

So far we have seen not an inkling of intelligence, nothing but instinct, inflexible instinct, guiding the architectural work. One more experiment will suffice. It will indicate the force of instinct even when opposed to sensual desires.

Experiment 5.—Suppose instinct impels the wasp in one direction and some sensual desire impels her in the opposite direction, which will conquer in the end. No doubt sometimes one, sometimes the other according to their relative strength at the time. Take, for example, this incident. Work is in progress. A cell is half complete. The mason is arriving every few minutes with a fresh load of clay. I place a lump of camphor inside the chamber. The *Eumenes*, like many insects, has a sense of smell and strongly dislikes the odour of camphor. What will she do? She cannot escape it. When she bends to mould a brick she will almost touch the nauseating lump. Instinct will impel her to build, the foul odour to withdraw. Let us see. She arrives. The smell arrests her when an inch from the cell. She hesitates, approaches warily, then doubtfully ascends the wall. Her head bends down to apply the brick. The odour drives her away. Again she approaches; again retreats before the fumes. This continues for a dozen efforts, the force of instinct impelling her to build, the olfactory stimulus preventing the act. At length there occurs a most determined effort. Down goes her head almost on the camphor and she trembles in the obnoxious fumes. Then with a few thrusts she moulds the pellet. But the act is hasty. It is a rough kind of masonry, ill-laid, and unworthy of her graceful cell. But it is enough. The force of instinct is fulfilled. The mason is off. Instinct in its conflict with the ordinary senses has won the day.

Nor is this all. The force of instinct persists. Again and again she comes with pellets, each time braves the stupefying fumes and persists in laying brick after brick. She even pushes in her abdomen and deposits an egg. Four succulent caterpillars arrive. Then the fœtid chamber is sealed. Instinct has unquestionably won. Yet in this case how false is instinct as a guide. The labour is wasted. No egg could ever develop in so offensive a cell.

Enough of these experiments. They illustrate the remorseless force of instinct in controlling the operations of the wasp. Did we stop here and investigate no further we would find that the cone-shaped mason of the east was no better than the *Chalicodoma* of Fabre.

But there is another side to the picture. Let us turn to it. I have some experiments which clearly prove that the mason is an intelligent creature.

EXPERIMENTS PROVING INTELLIGENCE

Occasionally we observe some trivial act, apparently slight and unimportant in itself, yet enough to arouse suspicion in our minds. Perhaps the mason is not so thoughtless. For example, one day she brings an unusually large pellet. It is too bulky for easy manipulation. There will be trouble in applying it to the wall. But she is not at a loss. Instead of going to her routine employment she climbs out on to the nest. There she searches for an uneven spot, and employs part of the pellet smoothening it.

The remainder, now of suitable size, is applied to its proper use on the wall. This is behaviour out of the ordinary. It suggests a trace of thoughtfulness, an indication, apart from experiment, that she can alter routine. Admittedly she has not abandoned masonry, only varied the sequence of the work. The time for working at the cover is after plug-insertion. But in this instance the wasp attends to the cover while still employed on her wall. If, finding her pellet too large, she had merely thrown away a portion, then the behaviour would be instinctive. But her action seems on a higher plane. She studiously seeks out some special defect in order not to waste clay.

Here is another suspicious incident. A cell has been built at sunset, an egg laid. I watch for the mason on the following morning, anticipating the usual stores. But, to my surprise, instead of caterpillars, she brings pellets. Then for hours she works at the cover without giving a thought to supplies. Again an alteration in routine, and, what is more, change in the nature of the task. Normally the time for storing comes after egg-laying. In this instance the sequence is interrupted. A certain amount of plastering takes place between the introduction of the egg and the supplies.

Now for the experiments, the less conclusive ones first.

Experiment 1.—The *Chalicodoma* provisions her cell with honey. M. Fabre, by employing a wad of cotton, drained away the store. This did not interfere with provisioning. The bees continued to bring honey in spite of its being systematically removed. In the end they layed their eggs, and closed the cells with a lid. The observer then measured the contents. The amount was different in each cell. In one it was three millimetres, in two one millimetre in depth, in others there was no honey at all. He concludes that the bee is so ruled by instinct that she does not even estimate the amount of her store. The sufficiency of honey is not measured by its height. She accumulates only so long as she feels the accumulating impulse. 'She does not reason like a geometrician, she does not reason at all.'

We will apply this test to the *Eumenes*. As fast as she brings caterpillars I will systematically rob the cell. A chamber is built. At 3 p.m. the first caterpillar arrives. It is large and fleshy. Two or three of that pattern will easily fill the cell. When she departs after introducing a caterpillar I extract it through the gate. At first she takes no notice. She continues to bring caterpillars, pushing them each time into an empty cell. By nightfall I have robbed her of five, a supply sufficient for two cells. She returns next morning. More caterpillars are brought. As before they are systematically robbed. The *Eumenes* now becomes concerned. She makes unexpected visits at frequent intervals, not bringing provisions, but merely to inspect the cell. Now and again another caterpillar comes. Capture after capture is pushed in, but the cell remains void. What an unaccustomed experience for the mason! Strenuous collection but no accumulation! Nothing like this ever happened before. Altogether I rob her of nine caterpillars. This is sufficient. There is no need to persist in the experiment, so

I allow her to store in peace. Then she brings two more, large ones, sufficient to fill the interior. She is satisfied and closes the gate. Thus in all she collected eleven, a supply more than enough to provision three cells.

Now for the conclusion. Her behaviour differs from *Chalicodoma*. It is not instinct alone which guides her. If it were, then she would have brought three or four caterpillars, the amount sufficient for one cell. Instinct would have been satisfied as in Fabre's *Chalicodoma*. But it is not satisfied. She knows that her chamber is empty: she persists until it is full. Her guide in storage is the quantity of provisions. She will not close her cell until it is packed tight. She estimates intelligently by measuring the height of the supplies.

Experiment 2.—This experiment concerns the young *Eumenes*. Here again we shall find superiority over the *Chalicodoma*.

Having taken a young bee from its prison, Fabre placed it in a tubular reed. He barred the entrance with a double door, the outer one of paper, the inner of clay. The young wasp, on emergence, was confronted with the earth. No difficulty about this. The earth barrier was penetrated just as if it was a cell wall. But the wasp could go no further. It could not penetrate the paper barrier. It died helplessly, not knowing how to get through.

Fabre supplies a simple explanation. The young wasp's instinct is to eat through its cell. That is the natural mode of escape. The completion of that act satisfies instinct, and instinct is so mechanical that the wasp cannot repeat the act. It can penetrate once, not twice. If, in the experiment, it bored through the paper, then it would perform a second time what ordinarily it does only once. Such repetition is impossible. Hence it dies rather than escape.

I repeat this experiment with the *Eumenes*. The larva, only a few days old, is transferred to a glass tube. There it develops as safely as in its natural cell. I block the tube with three mud barriers, formidable obstacles, each twice the thickness of a cell wall. I confess I do not anticipate the result. I expect to see the wasp eat through one partition, then live on for a day or two, but fail to perforate the second wall. Nature, however, is full of surprises. This species is not so bound to instinct. It is better than that investigated by Fabre. I look one morning to see what has happened. The three barriers have been perforated in succession and the wasp has left the tube.

Experiment 3.—While the *Chalicodoma* was provisioning M. Fabre made a breach in its cell. The mason was unable to close the rent. She merely continued to thrust in honey, which, of course, as quickly leaked out through the breach. Finally the bee introduced her egg, sealed the door, but made no effort to rebuild the breach. His explanation is as follows. The insect is controlled by rigid instincts. She must follow a psychic course, and perform her acts in a definite routine. She must keep to the occupation that engages her at the moment. Though confronted with damage of glaring importance, yet she cannot change her task.

Now for the cone-shaped mason. I break a hole in the bottom of a cell. The owner is absent, hunting for caterpillar. It is a gaping rent. I have made it so large that when a caterpillar goes in, it will very likely fall through the breach. She starts provisioning. The first caterpillar falls through the rent. Her next is so large that only part hangs out. The subsequent ones remain inside. Then she closes the gate. Not the slightest attention is given to the breach. So far her behaviour has been automatic. But now some enlightenment appears. At last she seems to see the damage. She examines the breach with the caterpillar dangling through it. If an automaton, she will be helpless in this emergency ; things will remain just as they are. But watch her behaviour. She stuffs back the caterpillar, by no means an easy task. Then she makes off, fetches a pellet and builds up the breach.

I regard this as a sign of intelligence, an indication that the mason appreciates difficulties and realizes how to put them right. Then why did she not repair when provisioning ? Merely because she was so pre-occupied. She did not notice the hole. At the final survey she sees it immediately. Then she not only repairs the damage, but also pushes back the grub.

Experiment 4.—I am not quite satisfied with the above experiments. They are not convincing enough. Here is more definite proof. She is plastering the cover, having completed a cell. I break open an adjoining chamber, one finished days before. She discovers the damage, makes no end of a fuss about it, pulls the caterpillars through the hole, then pushes them back. In the end, however, she brings pellets and repairs it in the usual way. This, after all, we might anticipate. She had been engaged at strengthening the cover so it is an ordinary feat to fill the hole.

But watch further. Having closed the breach, she returns to the cover. I reopen the breach, in fact make an immense rent through which a pencil might be passed into the cell. I extract the caterpillars, leaving a void behind. Here at last is a crucial test. Will she, as before, just repair the masonry, or will she in addition restore the supplies ? If the former, then her action is instinctive ; if the latter, then she works intelligently. She will have broken from the duty of the moment and departed altogether from routine.

Let us see. Very soon she arrives. Plastering is resumed. She does not attend to the breach immediately. Many irregularities first occupy her. Not till after a dozen journeys does she think about repair. Observe her actions now. She is faced with a ragged opening on one side of her cell. She investigates it, crawls through it, explores the void within. Then she takes suitable action. A pellet is brought. With it the edge is made even. The jagged rent is shaped into a circular hole. At the next visit I expect to see her close the opening. For remember she had been engaged at plastering the cover. Her employment was masonry ; therefore I anticipate a more filling of the branch. But when she arrives I am astonished at her actions. She goes direct to the breach, not just to fill it, to my surprise she encircles it with a rim. What can this forbode ? This is not the time for rim-construction ; this is not the place where that structure is applied. Is she going to treat it as if it were a gateway ? Is she by any possibility going to replenish the stores ? Her next visit will decide the point. A long absence arouses suspicion. If collecting clay, she should be back in a minute. I do not see her for quarter of an hour. At last she arrives, and to my delight I see a caterpillar dangling in her jaws. In the orthodox manner she pushes it in, then brings others, fills the cell to its utmost capacity, finally inserts a plug.

What is this ? I am losing faith in certain views on insect psychology. I am thinking that they work on higher principles than unchanging and unchangeable routine. She finds a breach in a cell when manufacturing her cover. Not only this, in addition the cell-contents have vanished, nothing but the egg remains. If an automaton what can she do ? At most she might close the opening. That would still be building work. But her mentality is higher. She shapes my rough opening into a circle, constructs a rim, replenishes the provender, seals the gate. These are actions far outside routine. They are in no way connected with cover-construction, the duty which she had in hand. This is not the course of undeviating instinct. It is the comprehension of new and unexpected problems and the solving of them by rational means. We have here no thoughtless automaton like the *Chalicodoma* of Fabre.

This concludes my series of experiments. I find that the wasp has powerful instincts. Under their obedience she lives and works and raises her graceful cell. But they do not bind her inexorably. She is not in slavery to strict routine. On the contrary she can break the chain of her behaviour, can appreciate new occurrences, can deal with emergencies, in fact can behave in a rational manner according as occasion requires.

REVISION OF THE FLORA OF THE BOMBAY PRESIDENCY

BY

E. Blatter, S.J., Ph.D., F.L.S.

Part II

(*Continued from page 557 of this Volume*)

34. TURNERACEÆ.[1] (Hutchinson i, 111).

Cooke does not mention this order, but as one representative is commonly cultivated in gardens and has run wild in many places, it must be included in the *Bombay Flora.*

Herbs or rarely shrubs. Leaves entire or lobed, alternate ; stipules 0. Flowers hermaphrodite, actinomorphic, yellowish. Calyx tubular, 5-toothed, teeth imbricate. Petals 5, inserted on the calyx-tube, free, clawed, contorted in bud. Stamens 5, inserted at the base of the corolla-tube ; filaments free ; anthers 2-celled, opening lengthwise. Ovary superior, 1-celled, with 3 parietal placentas ; styles 3, terminal, slender ; stigmas fringed ; ovules numerous. Fruit a capsule opening loculicidally into 3 valves with the placenta in the middle of each. Seeds arillate, pitted ; endosperm horny or fleshy ; embryo straight, large.

Species 105.—Subtropical and tropical, chiefly American.

Turnera, Linn.

Shrubs or herbs. Leaves alternate, simple, usually 2-glandular at the base ; stipules small or absent. Flowers regular, bisexual, axillary, solitary, rarely fascicled or in racemes, yellow ; peduncle sometimes adnate to the petiole, bracteoles 2 or 0. Hypanthium short, usually swollen at the insertion of the stamens. Sepals 5. Petals 5, hypogynous, inserted at the base of the hypanthium. Stamens 5, more or less perigynous and often connate at the base ; anthers oblong with longitudinal dehiscence. Ovary free, 1-celled with 3 parietal placentas ; styles 3, simple or with flabellately divided stigmas ; ovules numerous, anatropous, 2-seriate on the placentas. Fruit a 3-valved capsule bearing the seeds in the middle of the valves. Seeds oblong, curved, with a membranous aril ; albumen fleshy ; embryo terete.

Species 70.—Tropical American, only a few African and Asiatic.

1. **Turnera ulmifolia,** Linn. Sp. pl. 271.

Vern. name : Bhinjra.

Description : A herb or undershrub ; shoots densely hairy. Leaves broad- or narrow-lanceolate or elliptic-lanceolate, coarsely serrate, 7–10 cm. long, with 2 large glands at the end of the 10–25 mm. long petiole. Flowers yellow, 3·5–5 cm. in diameter ; peduncle adnate to the petiole and bearing a pair of leaves below the flower. Hypanthium funnel-shaped, hairy ; sepals lanceolate, 8–10 mm. long. Capsule sub-globose oblong, 8 mm. long, hairy, minutely tubercled, sometimes only 2-valved. Seeds elliptic-oblong, brown, rugose. (Haines).

Locality : Grown in gardens. Has become a common weed of waste ground and roadsides in many places of the Presidency.

Distribution : West Indies.

36. CAPPARIDACEÆ. (Cke. i, 35)

About 600 species.—Chiefly tropical.

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[1] The number in front of the family refers to the corresponding number in Hutchinson, *The Families of Flowering Plants.*

1. CLEOME, Linn. (Cke. i, 36)

Hooker f. and Thompson, Cooke and others give under the general characters of the genus the number of stamens 4–8. It should be 4-12-∞.

Two species and two varieties not known from the Presidency before have to be added.

Key to the Species—

I. Leaves simple—
  1. Stamens 6 or less
    (*a*) Leaves oblong—lanceolate penninerved, bracts petiolate ... ... 1. *C. monophylla.*
    (*b*) Leaves ovate, cordate, penninerved, bracts small, sessile ... ... 2. *C. papillosa.*
    (*c*) Leaves suborbicular, palmately 5-nerved, bracts leafy ... ... 3. *C. quinquenervia.*
    (*d*) Leaves fleshy, ovate or obovate, 3-nerved, bracts small ... ... 4. *C. Stocksiana.*
  2. Stamens 10–12
    Leaves oblong-lanceolate, bracts leafy ... 5. *C. simplicifolia.*
II. Leaves compound—
  1. Stamens 6 ; capsule sessile or subsessile
    (*a*) Leaflets filiform ... ... 6. *C. tenella.*
    (*b*) Leaflets linear-oblong to obovate
      * Stem and leaves not asperous... ... 7. *C. brachycarpa.*
      * * Stem and leaves with minute scattered prickles ... ... 8. *C. aspera.*
  2. Stamens 6, capsule stalked ... ... 9. *C. Burmanni.*
  3. Stamens indefinite
      * Flowers yellow, capsule glandular-pubescent ... ... 10. *C. viscosa.*
      * * Flowers rosy, capsule smooth ... ... 11. *C. Chelidonii.*
      * * * Flowers purple or pink, capsule glabrous, striate ... ... 12. *C. felina*

1. **Cleome monophylla,** Linn. Sp. pl. (1753), 672 ; Cke. i, 36.

Locality : Gujarat (Woodrow).—*Deccan :* Gadak (Woodrow).—*S. M. Country :* Belgaum (Ritchie, 24) ; Badami (Cooke ! Herb. S.X.C., 18167 !).

Distribution : From Bihar and Orissa and the Konkan to Ceylon, in fields and waste places ; tropical Africa.

Flowers : August (Badami).

Fruits : August (Badami).

Uses : According to Haines the leaves are eaten as a pot-herb. Campbell says that the pounded root is put on the lips by the Santals to restore consciousness when in a faint.

2. **Cleome papillosa,** Steud. Nomencl. ed. 2, i (1840), 382 ; Cke. i, 36.

Locality : Sind : Thano-Bula-Khan Road, 34 miles from Karachi (Woodrow !) ; Laki, foot of the hill (Sabnis 611 !) ; Sibi (Herb. S.X.C. 18173 !).

Distribution : Rajputana, Arabia, Abyssinia, Nubia, Kordofan.

Flowers and *fruits :* September (Sibi).

3. **Cleome quinquenervia,** DC. Prodr. I (1824), 239 ; Cke. i, 37.

Locality : Sind : Laki (Woodrow, Herb. S.X.C. 18174 !) ; hills in Sind (Vicary).

Distribution : Persia, Afghanistan, Arabia.

Flowers : October (Laki).

4. **Cleome Stocksiana,** Boiss. Diagn. ser. 2, fasc. 1 (1853), 47 ; Cke. i, 37.

Locality : Sind : Boogta Hills (Vicary) ; Laki (Woodrow ! Herb. S.X.C. 18175 !).

Distribution : Baluchistan.

5. **Cleome simplicifolia,** Hook. f. & Th. in F.B.I. i, 169 ; Cke. i, 37.

Locality : Konkan : Bombay (Law).—*Deccan :* near Poona (Dalzell) ; Poona (Jacquemont, 813,814); Deolali (Blatter, 18182 ! bis); Igatpuri (Blatter, 18117 !). —*S. M. Country :* Belgaum (Ritchie, 1018).

Distribution : Northern India, drier parts of the Deccan and Konkan.
Flowers and *fruits :* September 1917 (Deolali, Igatpuri).

6. **Cleome tenella,** Linn. f. Suppl. 300 ; DC. Prodr. i, 240 ; Wight and Arn. Prodr. 21 ; Wall. Cat. 6966 ; F.B.I. i. 169 ; Gamble 41.—*C. angustifolia,* A. Rich. Fl. Seneg. 20.
Description : An annual glabrous herb, up to 30 cm. high ; branches many, slender, spreading. Leaves 3-foliolate ; leaflets linear or filiform, as long as or longer than the petiole. Flowers minute, in few-flowered racemes ; bracts simple or 3-foliolate. Stamens 6. Ovary glabrous. Capsule sessile or subsessile, linear, glabrous, 2·5–3 cm. long. Seeds minute, smooth.
According to Gamble the flowers are yellow, according to the F.B.I. purplish. I have not seen fresh flowers, but judging from the dried specimens they seem to be yellow.
Locality : Deccan : Bijapur (Talbot, 2751 !).
Distribution : Dry places in the Carnatic Districts from Nellore to Tinnevelly and S. Travancore, Tropical Africa.

7. **Cleome brachycarpa,** Vahl, (*ined.*) ex DC. Prodr. i (1824), 240 ; Cke. i, 38.
Locality : Sind : Hills in Sind (Stocks 456) ; Boogta Hills (Vicary) ; Karachi (Woodrow ! Herb. S.X.C. 18171 ! Ticehurst 32281 !) ; Sukkur (Cooke !) ; Laki, Larkana, foot of hill (Sabnis B989 !) ; Thar and Pakar : Mirpurkhas (Sabnis B946 ! B1036 !).
Distribution : W. Rajputana, Punjab Plains, westward to Arabia, Abyssinia and N. Africa.

Var. longepetiolata, Sabnis in Jour. Ind. Bot. Soc. (*separatum*) (1924), 4.—Leaves 3–5 foliolate ; petioles up to 3–5 cm. long. Seeds notched and reticulated.
Locality : Karachi (Ticehurst 28141, !) ; Laki, foot of hill (Sabnis B621 !).

Var. glauca, Blatt. and Hall. in Journ. Bombay Nat. Hist. Soc. xxvi (1918),221.—Leaves 3-foliolate, above and below pale-glaucous, glabrous, except on the margin which is glandular—pubescent, petiole longer than in the type, reaching 13 mm. Branches glaucescent, slightly paler than the leaves. Seeds minutely reticulate.
Locality : Indus Delta : (Blatter and McCann D6 !) ; Ghulamallah, on lime-stone (Blatter and McCann, D5 !).
Vern. name : Kasturi.

8. **Cleome aspera,** Koen. (*ined.*) ex DC. Prodr. i (1824), 241 ; F.B.I., i, 169 ; Cke. i, 38 ; W. Ic. t. 287.
Locality : S. M. Country : Badami (Cooke ! Herb. S.X.C. 18168 !).
Distribution : N. Circars, Deccan and Carnatic, up to 600 m.
Flowers and *fruits :* August.

9. **Cleome Burmanni,** W. and A. Prodr. (1834), 22 ; F.B.I. i, 170 ; Cke. i, 39 ; Burm. Thes. Zeyl. t. 100, f. 1 (not very good).
Locality : Sind : Hyderabad (W. Strachan, fide Woodrow).
Distribution : Fields and dry places in the Carnatic District, Ceylon.
Note : Trimen (Fl. Ceyl. i, 56) thinks this species might be identical with *Cleome aspera.* Cooke says that *C. Burmanni* differs from *C. aspera* chiefly by the presence of a distinct gynophore. According to Gamble (p. 40 and 41) *C. Burmanni* has the stem and leaves glabrous, and the flowers purple, whilst *C. aspera* has stem and leaves asperous with minute scattered prickles and the flowers pink. Cooke describes the stem of *C. Burmanni* (but not the leaves) as rough with minute scattered prickles. My specimens, which are not of the Bombay Presidency, exhibit the characters given by Gamble. I doubt the occurrence of *C. Burmanni* in Sind.

10. **Cleome viscosa,** Linn. Sp. pl. (1753), 672 ; W. Ic. t. 2 ; F.B.I. i, 170 ; Cke. i, 39.—*Polanisia viscosa,* DC. ; Royle Il. 73.
Vern. name : Pioli-Tilwan (in Indus Delta).
Locality : Sind : Larkana, fields (Sabnis B92 !) ; Nasarpur (Sabnis B1139 !); Mirpurkhas (Sabnis B682 ! B947 !) ; Sanghar (Sabnis B767 !) ; Indus-Delta : Tatta (Blatter and McCann D4 !) ; Tatta, tombs (Blatter and McCann D2 !

D3 !) ; Gharo (Blatter and McCann D16 !) ; Ghulamallah, lime-stone hill (Blatter and McCann D15 !).—*Konkan :* Vingorla (Nairne) ; Bhandup, Salsette (Blatter and McCann 18180 !).—*Khandesh :* Bhusaval, bank of Tapti (Blatter 18176!).—*Deccan :* Poona (Cooke !).

Distribution : Throughout the tropics of the world.

Flowers : July 1917 (Salsette) ; December 1916 (Khandesh).

Fruits : July 1917 (Salsette).

Uses : According to Haines the seeds are said to have the same properties as mustard, and are regarded as anthelmintic, carminative and stimulant. When applied externally they act as a vesicant.

A fixed oil is extracted.

11. **Cleome Chelidonii,** Linn. f. Suppl. (1781), 300 ; F.B.I. i, 170 ; Cke. i, 39.—*Polanisia Chelidonii* DC. II ; W. Ic. t. 319 ; Royle Ill. 3.

Locality : Gujarat : Dang jungles (Woodrow !).—*Konkan :* Bombay (Blatter !),—*Deccan :* Between Poona and Karla (Jacquemont 812) ; Lonavla (Cooke !) ; near Poona (Woodrow !).—*S. M. Country :* Belgaum (Ritchie, 23).

Distribution : N. Circars and Deccan Districts of Madras Presidency, Java.

Uses : The seeds are said to be used in curries.

12. **Cleome felina,** Linn. f. Suppl. 300 ; Gamble 41.—*Polanisia felina,* DC. Prodr. i, 242 ; Wall. Cat. 6971 ; Wight and Arn. Prodr. 22 (*excl. syn.* Rheede Hort. Malab.).

Description : An annual erect herb, 30–60 cm. high, much branched ; stem and leaves entirely clothed with stiff appressed scale-like hairs. Leaves 3-foliolate ; leaflets 10–25 mm. long, obovate, obtuse, equalling or shorter than the petioles. Flowers axillary, solitary on long pedicels, 12–18 mm. long, purple or pink. Calyx and corolla bristly outside. Stamens about 30 ; filaments filiform. Capsule 8 times as long as broad, compressed, linear-oblong, acute at both ends, striate, glabrous. Seeds large, glabrous, tubercled.

Locality : Dharwar (Talbot 1956 !).

Distribution : Deccan and Carnatic Districts of Madras Presidency.

2. GYNANDROPSIS, DC. (Cke. i, 40)

1. **Gynandropsis pentaphylla,** DC.; Cke. i, 40.—*Cleome pentaphylla,* Linn.; Roxb. Fl. Ind. iii, 126.

Locality : Sind : Karachi (Ticehurst, 28151 !) ; Pad Idan in Nawabshah (Sabnis B508 !) ; Khairpur, sandy plains (Sabnis B232 !) ; Gharo (Blatter and McCann D1 !) ; Kullan Kote Lake near Tatta (Blatter and McCann D7 !).—*Khandesh :* Umalla, sand-bank of Tapti (Blatter and Hallberg 18151 ! 18152 !) ; Bor, bank of Tapti (Blatter and Hallberg 18160 !) ; Bhusaval (Blatter and Mc Cann 18159 !) ; Dangri, in fields (Blatter and Hallberg 18150 !) ; Muravad, bank of Tapti (Blatter and Hallberg 18149 !).—*Konkan :* Bombay Island (Blatter !).—*Deccan :* Igatpuri, in damp ground (D'Almeida 17617 !) ; Ahmednagar (Cooke !) ; Poona, cultivated fields (Jacquemont 810) ; Panchgani (Blatter !).—*S. M. Country :* Belgaum (Ritchie 1158).

Distribution : A common weed in all tropical countries.

Flowers : December 1916 (Khandesh).

Fruits : October 1917 (Igatpuri), December 1917 (Khandesh).

3. DIPTERYGIUM, Decaisne. (Cke. i, 40.)

1. **Dipterygium glaucum,** Decaisne ; Cke. i, 40.

Locality : Sind : Jacobabad (Herb. S.X.C. 18153 !) ; Umerkot, sandy plains (Sabnis B945 !), sand dunes (Sabnis B1012 !).

Flowers : September 1908 (Jacobabad).

4. MÆRUA, Forsk. (1775) (Cke. i, 41)

Species about 20.—Tropical Africa, Asia, Arabia.

Mærua ovalifolia should be called :

1. **Mærua arenaria,** Hook. f. and Th. in F.B.I. i, 171 ; Brandis Ind. Trees, Fig. 13 ; Gamble 42.—*M. arenaria,* var. *glabra,* Hook. f. and Th. in F.B.I. i, 171.—*M. arenaria,* var. *scabra,* Hook. f. and Th. l. c. i, 171.—*Niebuhria arenaria*

DC. Prodr. i, 244.—*N. oblongifolia*, Royle Ill. Bot. Himal. 73.—*Mœru ascabra* Cambess. in Jacquem. Voy. Bot (1844), 22, t. 23.—*Mœrua ovalifolia*, Cambess. l. c. 22, t. 24 ; Cke. i, 41.—*Capparis heteroclita*, Roxb. Fl. Ind. ii, 570.

The above synonymy contains the two varieties of Hook. f. and Th. in the F.B.I. which, in my opinion, cannot be retained as good varieties.

The stem is often as thick as a man's arm.

Locality : Sind : Indus-Delta : Ghulamallah, lime-stone hill (Blatter and McCann D 700–706 !), associated with *Acacia sp.* and *Euphorbia neriifolia.*—*Konkan* : (Law).—*Deccan :* near Poona (Cooke ! Woodrow !) ; between Wai and Kamatki Ghat (Graham).—*Gujarat :* Deesa (Law), hedges (Dalzell and Gibson).—*S. M. Country :* Dharwar (Talbot !).

Distribution : Punjab, Central and S. India, Ceylon.

Flowers : October 1922 (Indus Delta).

5. CRATÆVA, Linn. (Cke. i, 41)

Species 10.—Tropics.

Of the one species found in the Bombay Presidency viz. *Cratœva religiosa.* Forst. Cooke retains two varieties : var. *Nurvala*, Hook. f. and Th. and var. *Roxburghii*, Hook. f. and Th. and in this he follows the F.B.I. Hook. f. and Th. call the plant very variable, adding that intermediates may be found between the two varieties. They point out that the form of the ovary anf fruit does not always correspond with that of the leaflets. I have never been able to place Bombay specimens under the two varieties. The following synonymy shows that I have dropped the varieties.

1. **Cratæva religiosa**, Forst. f. Prodr. (1786), 35 ; F.B.I. i, 172, *cum var.* ; Cke; i, 42, *cum var.* ; Gamble 47 ; Troup Silvic. i, 10, Fig. 7 ; Bedd. Fl. t. 116 ; Haines 30.—*C. Roxburghii*, Br. in Denh. and Clapp. Travels, App. (1826), 224 ; Hook. Ic. Pl. 178.—*C. religiosa*, var. *Roxburghii*, Hook. f. and Th in F.B.I. i, 172 ; Cke. i, 42.—*C. Nurvala*, Ham. in Trans. Linn. Soc. xv (1827), 121.—*C. religiosa*, var. *Nurvala*, Hook. f. and Th. in F.B.I. i, 172 ; Cke. i, 42.—*Capparis trifoliata*, Roxb. Fl. Ind. ii, 571.—Rheede Hort. Malab. iii, t. 42.—

Vern. names : ' Barna, biliana ' (Hind.), ' nirvala ' (Mar.), ' Bitusi ' (Kan.).

Description : Cke. i, 42.—Filaments white when young, lilac when old ; gynophore lilac ; petals whitish when young, yellowish when old ; sepals green when young, yellow when old. (D'Almeida).

Locality : Konkan : Bombay (Blatter !) ; Salsette (Blatter !) ; Karanja Hills (Dalzell and Gibson) ; Wari jungles (Dalzell and Gibson) ; Vehar Lake (D'Almeida 18178 !).—*Gujarat :* Banks of Narbada, near Chandad (Dalzell and Gibson).—*Kanara :* Chandwar (Ritchie 29) ; Hulical (Woodrow !).

Distribution : Almost all over India and Burma, wild or cultivated. Often found along streams, but sometimes almost gregariously on dry deep boulder formations in the sub-Himalayan tract (Troup.).

Flowers : November 1915 (Vehar Lake).

Uses : Wood used for combs. Fruit sometimes eaten (Haines).

6. CADABA, Forsk. (1775) (Cke. I, 43)

I cannot discover any specific difference between *Cadaba indica*, Lam. and *C. farinosa*, Forsk.

The only character to separate *C. indica* from *C. farinosa*, would be the number of stamens. Hooker and Cooke give 4 stamens to *C. indica*, and 5 to *C. farinosa*, and Cooke uses this difference in his key. But considering that flowers with 4 and 5 stamens may be seen on the same twig of *C. indica*, the number of stamens cannot form a specific character. The mealiness of the leaves which induced Forskal to give his plant the specific name '*farinosa*', can also be observed in *C. indica.* Besides it could not be of any systematic value. It may offer a basis for a form. In view of these facts I reduce *C. indica* to *C. farinosa.*

1. **Cadaba farinosa,** Forsk. Fl. Aeg.—Arab. (1775), 68 ; Hook. f. and Th. in F.B.I. i, 173 ; Deless. Ic. Sel. iii, t. 8 ; Cke. i, 43 ; Parker 18.—*Cadaba indica*, Lam. Encycl. i (1783), 544 ; Hook. f. and Th. in F.B.I. i, 172 ; Cke. i, 43 ; Blatt. and Hall. Fl. Ind. Desert in Journ. Bomb. Nat Hist. Soc., vol. xxvi

(1918), 222.—*Strœmia tetrandra et farinosa*, Vahl Symb. Bot. i, 20; Roxb. Fl. Ind. ii, 78.—*Cleome fruticosa*, Linn. Sp. pl. 671.

Description: An unarmed, straggling, much-branched shrub, up to 3 mm. high. Stems terete, the older smooth, purplish, the younger pubescent, yellowish-brown. Leaves 12–35 mm., by 8–12 mm., simple, entire, elliptic-oblong, or ovate, or oblong, obtuse or retuse, mucronate, dull green, mealy when young, glabrous when mature, reticulately veined, base rounded; petioles 2·5–4 mm. long. Flowers dirty-white, 15 mm. across, in few-flowered, terminal, 1-sided racemes, the upper flowers corymbose; pedicels 9–18 mm. long, pubescent; bracts minute, subulate. Sepals 8–13 mm. long, the two outer boat-shaped, valvate, the two inner flat, ovate, acute, petaloid, all pubescent outside. Petals 4, very pale-yellow, spatulate, equalling the sepals; claws long, slender. Disk prolonged into a tubular process, 8–9 mm. long, mouth oblique, pale rose-coloured, toothed at apex. Stamens 4 or 5 inserted about half-way up the gynophore; filaments long. Ovary oblong on a gynophore 17–23 mm. long; style 0. Fruit 2·5–5 cm. by 3 mm., cylindric, irregularly torulose, glabrous or pubescent. Seeds many, striate, surrounded by an orange-red aril.

Locality: Sind: (Stocks, Dalzell); Indus Delta: Gharo (Blatter and McCann D9!); Tatta (Blatter and McCann D10!); Tatta tombs (Blatter and McCann D11!); Mirpur Sakro (Blatter and McCann D12! D13!); Ghulamallah, lime-stone hill (Blatter and McCann D14!).—*Gujarat:* Junaghad (Cooke!); Porbundar (Cooke!); Surat (Woodrow!).—*Konkan:* Cross Island, Bombay harbour (Stocks); Cumballa Hill, Bombay (Blatter 18157!); Salsette (Herb. S.X.C. 18155!); Sion (Hallberg!); Worli (Hallberg!).—*S. M. Country*: Belgaum (Ritchie 980); Dharwar (Cooke!); Gadag (Herb. S.X.C. 18179!).

Distribution: Punjab, Indian Desert, Central India, Bombay Presidency, dry Districts of the N. Circars, Deccan and Carnatic from Vizagapatam southwards, Madura district.

Flowers: January 1891 (Gadag); February 1910 (Salsette); March 1917 (Bombay).

Fruits: January 1891 (Gadag).

7. CAPPARIS, Linn. (Cke. i, 44)

Species about 170.—In all warm climates, except N. America.

In the following one species, *C. diversifolia* not known from the Presidency before, has been added; one variety, *C. spinosa*, var. *galeata*, has been raised to the rank of a species, and another species, *C pedunculosa*, Wall., has been excluded as not occurring in the Presidency. Some new varieties have been described and several specific names and their synonymy had to be revised.

Key to the species, modified from Cooke.—

I. Flowers axillary, solitary, or in fascicles of 2–3—
  1. Prostrate shrubs, leaves orbicular or ovate orbicular, thorns usually hooked
    (*a*) Lower sepal not very saccate ... ... 1. *C. spinosa.*
    (*b*) Lower sepal very saccate ... ... 2. *C. galeata.*
  2. Erect shrub, leaves ovate-lanceolate, thorns straight ... ... 3. *C. brevispina.*
  3. Erect shrub, leaves elliptic-lanceolate, thorns minute or 0 ... ... 4. *C. Heyneana.*
  4. Shrub or small tree, leaves narrow-oblong, thorns straight ... ... 5. *C. stylosa.*

II. Flowers corymbose (sometimes racemose in *C. grandis*)
  1. Mature branches leafless ... . 6. *C. decidua.*
  2. Mature branches leafy—
    (*a*) Flowers 10–12 cm. across ... ... 7. *C. Moonii.*
    (*b*) Flowers 2·5–3·5 cm. across
      * Leaves glabrous, linear or oblong-lanceolate. 8. *C. diversifolia*
      ** Leaves glabrous, oblong or obovate ... 9. *C. Cleghornii.*
      *** Leaves olive-green, pubescent when young ... 10. *C. grandis.*

III. Flowers in shortly peduncled or sessile umbels
  1. Erect shrub ... ... 11. *C. longispina.*
  2. Woody climber ... ... 12. *C. sepiaria.*

IV. Flowers supra-axillary in a vertical line on the branches
  1. Young parts fuscous-tomentose ... 13. *C. zeylanica.*
  2. Young parts glabrous ... ... 14. *C. tenera.*

1. **Capparis spinosa**, Linn. Sp. pl. (1753), 503; F.B.I. i (1875), 173; Talbot i, 52, fig. 32; Cke. i, 44.—*C. Murrayana*, Grah. Cat. 9; Dalz. and Gibs. 9; Wight Ill. t. 379.—*C. spinosa* var. *vulgaris*, Hook. f. and Th. in F.B.I. i (1875), 173.—*C. leucophylla*, DC. Prodr. i, 246; Collett. Fl. Siml. 38.—*C. spinosa* var. *leuco-phylla*, Hook. f. and Th. l. c. 173.

Collett retains *C. leucophylla*, DC. as a distinct species on account of the larger leaves and more pronounced tomentum; but Upper Sind specimens show similar variations, and intermediate forms are not wanting. It must, therefore, be dropped, even as a variety.

Description: Cooke's description is sufficiently wide to comprise both varieties.

Locality: Sind: Karachi, Soorjana Hills, 550m. (Ticehurst 30885!); Larkana, kalar soil (Sabnis B454! B463!); Kirthar Range (Woodrow!); Ruk Junction (Cooke!); Sukkar, kalar soil (Sabnis B542!).—*Konkan:* (Law *ex* Cooke); Raighur (Dalzell).—*Deccan:* Lohagad (Blatter!); Mahableshwar (Cooke! Herb. S. X. C. 17121!); Harishchandar (Gibson).

Distribution: Mediterranean region, N. Africa, Asia, Australia.

Uses: An interesting account of the Caper industry in France is given in *La Co-operation de Production dans l'Agriculture* by the Comte de Rocquigny. It is translated in the *Journal of the Board of Agriculture*, vol. iv, 221, and reprinted in the Kew Bulletin (1898), 31.

2. **Capparis galeata**, Fres. in Mus. Senckenb. ii, 111; Oliv. Fl. Trop. Af. i, 95.—*Capparis spinosa* var. *galeata*, Hook. f. and Th. in F.B.I. i (1875), 173; Cke. i (1903), 44.

Distinguished from *C. spinosa* by the lower sepal being very saccate.

This plant seems to be confined in the Presidency to the western coast of Sind. I have not seen it in the Indus Delta.

Distribution: Persian Baluchistan, Arabia, E. Africa near the sea.

3. **Capparis brevispina**, DC. Prodr. i, 246; Wight and Arn. Prodr. i, 24; Hook. Ic. Pl. t. 126; Grah. Cat. 8; Dalz. and Gibs. 9; Gamble 45; Haines 31; .—*C. zeylanica*, Hook. f. and Th. in F.B.I. i, 174 (*non* Linn., *excl. syn. C. rotundifolia*, Rottb.); Cke. i (1903), 45 (*non* Linn.).

It will be seen from the references given above and from those under *C. zeylanica*, Linn. below that there is a considerable amount of confusion as to the correct names of the two plants. S. T. Dunn [Kew Bull. (1916), 62] has cleared up all doubt on the subject. He says: 'The first species of *Capparis* to receive a binominal designation was the common hook-thorned species of Ceylon and S. India which has two or more flowers in supra-axillary rows and globular glabrous ovaries. It was collected by Hermann in Ceylon and came with his herbarium into the hands of Linnæus, after being lost to the botanical world for about seventy years. This herbarium formed the foundation of the *Flora Zeylanica*. The collection consists of fragments of plants glued into 5 large volumes which now stand on the shelves of the Botanical Department of the Natural History Museum (Cromwell Road). They are the actual volumes referred to by Linnæus as 'in *forma atlantica*' (atlas folio) in the preface to the flora, and the specimens are his types. Specimens of the Caper named by him as above (Sp. Pl. ed. 2,720 (1763)) occur twice in the herbarium and although two and a half centuries old are still in quite good condition and easily recognizable as the species afterwards known as *C. horrida*, Linn. f. The younger Linnæus received specimens of the same species from Koenig and presumably not having seen Hermann's herbarium, and there being no specimen in his father's herbarium, published it again under the latter binominal. This name was doubtless communicated for Koenig and became the recognized appellation of the Caper among his friends and their successors. Roxburgh reverted to the correct name, but Wallich, Wight, Wight and Arnott and all recent writers have followed the mistake of the younger Linnæus.

'But not only did the early botanists of S. India fail to apply Linnæus's name to the common plant intended by him, they used it to indicate a perfectly distinct species. The mistake was followed by Wildenow, Wallich and most modern authors. But De Candolle for the first time recognized that it really was a distinct species and gave it the name of *C. brevispina*, and this name, which was adopted by Wight and Arnott and other botanists must stand.'

Locality : Konkan : Bombay Island (Hallberg !) ; Vingorla (Dalzell and Gibson).—*Deccan :* W. Deccan (Dalzell and Gibson).—*N. Kanara :* (Talbot !).—S.M. *Country :* Dharwar (Talbot !)

Distribution : N. Circars, Deccan, Carnatic, W. Peninsula, Ceylon.

Uses : Eaten after boiling (Haslett).

4. **Capparis Heyneana**, Wall. Cat. (1828), 6985 ; Cke. i (1903), 45.—Rheede Hort. Malab. vi, t. 57.

Locality : Konkan : Bombay, Victoria Gardens, planted ? (Blatter !) ; Ghats of S. Konkan (Talbot !).—*N. Kanara :* (Ritchie 1614) ; evergreen forests (Talbot !) ; Divimana (Woodrow ! Herb. S.X.C. 18135 !).

Distribution : W. Peninsula, W. Ghats in Tinnevelly District, Ceylon.

5. **Capparis stylosa**, DC. Prodr. i, 246 ; Grah. Cat. 8 ; Dalz. and Gibbs. 10.—*C. divaricata*, Wight and Arn. Prodr. i, 27 (*non* Lam.) ; W. Ic. t. 889 ; Hook. f. and Th. in F.B.I. i, 174 ; Cke. i (1903), 45.

'This is the Caper,' says Dunn (Kew Bull. (1916), 61), with straight thorns, flowers 2–5 in. across and large muricate fruit which was figured by Wight (Ic. t. 889) under the name of *C. divaricata*, Lam. Subsequent writers have followed this nomenclature. Lamarck had neither flowers nor fruit when describing his species, and it so happened that there are two S. Indian *Capparis* hardly distinguishable by their leaves and thorns but readily seen when in flower or fruit to be quite distinct. Lamarck mentions that in *C. divaricata* 'Les aiguillons sont geminés, court et crochus ' (*Encycl.* i, 606) which would tend to show that it did not belong to the species figured by Wight and described by subsequent writers under that name. But, in any case, it is only safe to designate these two allied species by the names given to them afresh after flowers or fruit were known. The first name which can definitely be claimed for the large-flowered and rough-fruited kind is *C. stylosa*, DC. (Prodr. i, 246). . . . Similarly the second may safely be cited as *C. diversifolia*, Wight and Arn.'

Colour of flowers : Greenish (Cooke), red (Graham, Gamble) ; I have seen them red.

Locality : Deccan : Common all over (Dalzell and Gibson). *S. M. Country:* Badam (Herb. S.X.C. 17119 !).

Distribution : In the Madras Presidency in dry forests of the Deccan and Carnatic from Kurnool to Tanjore up to 450 m. (Gamble).

6. **Capparis decidua**, Pax in Engl. and Prantl. Pflanzenf. iii, pt. 2, 230, 231 ; Sabnis Fl. Sind in *Journ. Bot. Soc. Ind.* (reprint), 5.—*Sodada decidua*, Forsk. Fl. Aegypt.—Arab. (1775), 81.—*Capparis Sodada*, R. Br. in Denh. Clapp. and Oudn. Trav. 225.—*C. Aphylla* Roth Nov. Pl. Sp. (1821), 238 ; Hook. f. and Th. in F.B.I. i, 174 ; Brandis For. Fl. t. 3 ; Royle Ill. 72 ; Cke. i, 46 ; Talbot I, 57, Fig. 36.

Locality : Sind : Karachi, Magho Pir (Sabnis B206 !) ; Larkana, kalar soil (Sabnis B443 !) ; Sehwan, sand dunes (Sabnis B665 !), kalar soil (Sabnis B351 ! B592 !) ; Laki, foot of the hill (Sabnis B11 ! B280 !) ; Nawabshah, Pad Idan (Sabnis B504 ! B571 ! B573 !) ; Khairpur, Mir's Forest (Sabnis B323 !) ; Hyderabad, Phuleli canal banks (Sabnis B188 ! B189 !) ; Koari, Indus banks (Sabnis B388 !) ; Sukkur, kalar soil (Sabnis B543 !) ; Thar and Parkar : Nasarpur, sandy plains (Sabnis B1046 !) ; Mirpurkhas, water course (Sabnis B850 ! B874 !) ; Sanghar (Sabnis B768 !) ; Umerkot, sandy plains (Sabnis B934 !) ; Indus Delta : Gharo to Mirpur Sakro (Blatter and McCann !) ; Gharo (Blatter and McCann !) ; Ghulamallah (Blatter and McCann D8 !).—*Cutch :* Bhuj (Blatter 18142 !) ; Karee Roa (Blatter 18143 !).—*Kathiawar :* Bhavnagar (Blatter 18133 !).—*Khandesh :* Muravad, bank of Tapti (Blatter and Hallberg

18130 !) ; Umalla, bank of Tapti (Blatter and Hallberg 18145 !).—*Deccan :* Near Poona (Woodrow !) ; island in Poona River (Cooke !) ; common on alluvium along the banks of the Deccan rivers mixed with *Acacia arabica* and *Zizyphus jujuba* (Talbot).

Distribution : Tinnevelly, W. Peninsula, C. India, Deccan, Rajputana, Sind, Punjab, Baluchistan, Arabia, N. Tropical Africa, Egypt.

Flowers : February (Bhavnagar), October (Indus Delta), December (Cutch).

Uses : The flower-buds and ripe or unripe fruits are pickled (Parker). The wood is very strong and durable. In W. Rajputana it is used to make the pivots of the stone hand mills with which flour is ground. In sandy places it is used to make the foundation of well-walls, the first layer being formed with this wood, and the masonry built on the top of it. Branches used for fences. The wood is valuable because it is not attacked by Termites. In Baluchistan the tips of the fresh young twigs are crushed and soaked in water. The water is strained off, sometimes two or three times. The residuum is dried and allowed to solidify. A tiny piece of it is eaten with butter and gives relief from pain after a bruise or fall. Also makes a very strong plaster.

7. **Capparis Moonii,** Wight Ill. i (1840), 35 ; Cke. i (1903), 46 ; Gamble 45.

Locality : Konkan : Bombay Island (Blatter !).—*W. Ghats :* Khandalla (Cooke ! Loele 18140 ! Blatter 18149 !).—*Deccan :* Satara (Herb. S.X.C. 17593 !).—*S. M. Country :* Ramghat (Ritchie, 26).—*N. Kanara :* Evergreen forests along the Ghats (Talbot !).

Distribution : Occurs also south of the Presidency on the W. Ghats down to Travancore and Tinnevelly up to 600 m. (Gamble).

Flowers : March 1917 (Khandalla), May 1917 (Satara).

Fruits : May 1899 (Khandalla).

Var. tomentosa, Blatt. and Hall. *var. nov.-Ramulis foliisque tomentosis.*

Locality : Sion Wood on Bombay Island (Herb. S.X.C. !).

8. **Capparis diversifolia,** Wight and Arn. Prodr. 27 ; Hook. Ic. Pl. t. 181 ; F.B.I. i. 175 ; Gamble 45.—? *C. divaricata,* Lam. Encycl. i. 606.

Description : A glabrous shrub ; branches zigzag, when young puberulous ; thorns recurved, base broad. Leaves glabrous, linear or oblong-lanceolate, 3·5–5 cm. by 6–18 mm., uppermost usually, rarely all, twice as long and ovate-lanceolate, coriaceous, shining above ; petiole up to 4 mm. long. Flowers about 3·5 cm., purple, in few-flowered terminal subsessile corymbs ; pedicels stout, subclavate, puberulous, umbelled, 1–3-flowered, sessile at the ends of leafy twigs. Sepals ovate, acute. Petals broad-obovate. Ovary narrow-oblong, glabrous. Fruit 3·5 cm. long, ovoid or oblong, smooth, many-seeded.

Locality : Deccan : Diva Ghat (Blatter and McCann 17615 !).

Distribution : Eastern slopes of the W. Ghats in the Bombay Presidency, Coimbatore and Tinnevelly.

9. **Capparis Cleghornii,** Dunn in Kew Bull. (1916), 61 (*nomen nudum prius publicum factum a cl.* Gamble in Flora Madras, i (1915), 46.—*C. Roxburghii,* Cooke Fl. Bomb. i (1903), 46 (*excl. syn.*) ; Hook. f. and Th. in F.B.I. i, 175 (*partim, non* DC.).

The nearest ally is *C. Roxburghii,* DC., but *C. Cleghornii* is distinguished from it by the flower-buds being tomentose and the leaf-nerves divaricate. In *C. Moonii* the flowers are 10–12 cm. across, the thorns short, stout, hooked, and the young branches glabrous (except in var. *tomentosa*), whilst *C. Cleghornii* has the flowers only 3–4 cm. across, few or no thorns, and the young branches hoary.

Locality : In the Bombay Presidency this plant has been found in Kanara only (Stocks *ex* Cooke). Cooke mentions also Kumpta and Ankola Ghat but Talbot denies the occurrence of this species in N. Kanara.

Distribution : Forests of the W. Ghats in S. Kanara and Mysore.

10. **Capparis grandis,** Linn. f. Suppl. (1781), 263 ; Cke. i (1903), 47 ; Gamble 46.—*C. bisperma,* Roxb. Fl. Ind. ii, 568.

Dunn points out that the type specimen originating from Ceylon has nearly glabrous leaves. The usual form found in S. India has the leaves olive-green velvety on both sides, in any case never quite glabrous. The same can be said of the Bombay specimens.

Locality : Deccan : Forests of Sholapur and Miraj (Dalzell and Gibson) ; Buleshwar Hill, 30 miles E. of Poona (Woodrow !) ; island in the Mutha-Mula River, Poona (Kanitkar ! Herb. S.X.C. 18128 !) ; near Poona (Cooke ! Moses Ezechiel 17612 !).—*Kanara* (Law *ex* Cooke). *S. M. Country :* Forests of Dharwar District (Talbot) ; Belgaum (Ritchie 979).

Distribution : Outside the Presidency it occurs at Mt. Abu, in the hill forests of the Deccan, Carnatic and eastern slopes of the W. Ghats from the Godavari southwards (Gamble).

Flowers : April and May (Poona).

11. **Capparis longispina,** Hook. f. and Th. in F.B.I. i. 176.—*C. pedunculosa,* Dalz. and Gibson 9 (*non* Wall.).—*C. pedunculosa* var. *longispina,* Cooke in Cke. i (1903), 48.

I restore Hook. f. and Th's *Capparis longispina* to the rank of a species. It had been reduced by Cooke (l. c.) to a variety of *C. pedunculosa,* Wall (see below under *Species excludenda*).

I consider *C. longispina* to be a good species. The stipular spines are straight, acicular, divaricate. The upper surface of the dark green leaves is shining, the lower more or less pubescent. *C. pedunculosa,* however, has the spines hooked and the leaves glabrous and not shining on the upper side.

Another reason why I wish to separate the two species is their peculiar distribution. *C. longispina* is a plant of the W. Ghats of the Bombay Presidency and has not been found anywhere else. *C. pedunculosa,* on the other hand, is a coast plant, having been noted in Nellore and at Point Calimere in Tanjore.

Locality : Konkan : Dense woods of the Ghats (Stocks, Law) ; Matheran (Cooke ! D'Almeida 17613 ! 17620 ! 18127 !).—*Deccan :* Mahableshwar (Moses Ezechiel 17616 ! Cooke !).—*N. Kanara :* Along the Ghats (Talbot).

Distribution : Endemic.

Flowers : March (Matheran, Mahableshwar).

12. **Capparis sepiaria,** Linn. Syst. ed. 10 (1759), 1071 ; Camb. in Jacquemont Voy. Bot. t. 22 ; Cke. i (1903), 48.—*C. incanescens,* DC. Prodr. i, 247 ; Hook. Ic. Pl. t. 123.

Locality : Sind (*ex* F.B.I.).—*Konkan :* Bandra (Herb. S.X.C. 18147 !).—*Deccan :* Lina Hill, Nasik District (Blatter 17618 !) ; Nasik (Cooke !).—*Khandesh :* Muravad, bank of Tapti (Blatter and Hallberg 18129 !).—*Kanara :* Halyal (Ritchie 1607).

Distribution : Dry parts of India and Ceylon, Philippines.

Flowers : February (Bandra).

Var. **vulgaris** Hook. f. and Th. in F.B.I. i, 177.—*Ramulis molliter tomentosis ; foliis typo latioribus.*

Locality : Bombay Island (Herb. S.X.C !). Further specimens must be examined before we are able to say whether it is a good variety.

13. **Capparis zeylanica,** Linn. Sp. ed. 2 (1762), 720 ; DC. Prodr. i, 247 ; Roxb. Fl. Ind. ii, 567 ; Gamble 46.—*C. horrida,* Linn. f. Suppl. (1781), 264 ; Wight and Arn. Prodr. i, 26 ; W. Ic. t. 173 ; Grah. Cat. 9 ; Dalz. and Gibs. 10 ; Brandis Ind. Trees, Fig. 14 ; Hook. f. and Th. in F.B.I. i, 178 ; Cke. i, 48 ; Parker 21 ; Haines 31.

In spite of Dunn's explanation cited above under *C. brevispina,* Haines considers it very 'inadvisable to retain the name *zeylanica,* which has for so long been used for another plant.'

I cannot share his view ; it will pay in the end if we stick strictly to the laws of nomenclature.—That Prain in his Fl. Bengal, referring to the name *zeylanica,* adds : 'not of Linn,' may be explained by saying that, with regard to this detail, he followed the F.B.I. too closely.

Locality : Sind : Pad Idan in Nawabshah (Sabnis B561 !).—*Konkan :* Bandra (Blatter 18146 !) ; Bhandup, Salsette (Blatter 18131 !) ; Vehar Lake (Blatter and McCann 17594 !) ; Penn (Blatter and McCann 17600 !) ; Kampoli (Blatter and McCann 18136 !).—*Deccan :* Igatpuri (McCann 17619 !); Khandalla (Blatter and McCann 18148!) ; Poona (Cooke !) ; Diva Ghat (Blatter and McCann 17623 !).—*S. M. Country :* Belgaum (Ritchie 25).

Distribution : Throughout the greater part of India to Java and the Philippines.

Flowers : November 1916 (Salsette) ; December 1917 (Diva Ghat) ; January 1917 (Salsette) ; February 1917 (Penn and Salsette) ; March 1917 (Kampoli and Khandalla).

14. **Capparis tenera,** Dalz. in Hook. Kew Journ. Bot., ii, (1850), 41 ; Cke. i (1903), 48.
Locality : See Cke. l. c.
Distribution : All along the Ghats of Western India down to Malabar and in Ceylon.

Var. Dalzellii, Hook. f. and Th. in F.B.I. i, 179.—*Foliis ovato-lanceolatis, permembranaceis, floribus saepe solitariis.*
Locality : North Kanara : Siddapore (Talbot).

Species excludenda

Capparis rotundifolia, Rottl. Gesellsch. Naturf. Fr. Neue Schr. iv (1803), 185.—*C. pedunculosa,* Wall. Cat. (1828), 6999 ; Hook. f. and Th. in F.B.I. i, 176 (*emendato numero in C. Wallichii*) ; Hook. Ic. Pl. t. 128 ; Bedd. Ic. t. 277 ; Cke. i (1903), 47.

According to Dunn (Kew Bull. (1916), 62, Rottler was the first to describe this species. The type specimen in the Kew Herbarium is the same plant which later on was labelled *C. pedunculosa* by Wallich.

This species seems to be endemic on the east coast of the Madras Presidency.

37. MORINGACEÆ

One genus and at least 4 species.—See Durin, E. Contributions à l'étude des Moringés. Rev. gén. Bot. xxv (1923), 449–471.

Moringa, Lamk.

The name of *Moringa pterygosperma,* Gaertn. (in Cke. i, 282) must be changed into :

1. **Moringa oleifera,** Lamk. Encycl. i, 398 ; Gamble 269 ; Haines 225.—*M. pterygosperma,* Gaertn. Fruct. 2 (1791), 314 ; W. Ill. t. 77 ; Bedd. Pl. t. 80 ; Cke. i, 282 ; Talbot i, 364, Fig. 212 ; Troup Silvic. i, 249.
Vern. Names : Shevgi (Mar.) Nuggi-mara (Kan.), Shivga, Shegla, Segata (vern.). (The generic name is taken from the Tamil name Moringa).
Localities : Cultivated all over the Presidency.
Distribution : 'Indigenous in the sub-Himalayan tract from the Chenab to the Sarda, and in Oudh, growing plantifully on recent alluvial land in or near the sandy or shingly beds of rivers and streams.' (Troup).

2. **Moringa concanensis,** Nimmo in Grah. Cat. Bomb. Pl. (1839), 43 ; Hook. Ic. t. 2596; Cke. i, 283 ; Talbot i, 365 ; Gamble 270.
Vern. names : Ran-shegat (Mar.), Mhua (Sind.).
Localities : Sind (Dalzell).—*Konkan :* Penn (Blatter and McCann !).—Seems to be rare, but may have been overlooked on account of its resemblance to the foregoing species.
Distribution : Baluchistan, Rajputana (Mount Abu, Barmer), N. Circars and Deccan from Vizagapatam to Guntur, Kurnool and Coimbatore.
Uses : Fruit edible.

40. VIOLACEÆ. (Cke. i, 51)

Bentham and Hooker's characters of the genus have been slightly changed by Hutchinson, p. 115.

Herbaceous perennials or shrubs, rarely annuals. Leaves alternate, rarely opposite, simple ; stipules leafy or small. Flowers solitary or paniculate, actinomorphic or zygomorphic, hermaphrodite, rarely polygamous, sometimes cleistogamous ; sepals 5, persistent, imbricate. Petals 5, mostly unequal, the lowermost often larger and spurred, imbricate or contorted. Stamens 5, mostly hypogynous ; anthers erect, more or less connivent in a ring around the ovary, introrse, opening lengthwise, the abaxial stamen often spurred at the base. Ovary free, sessile, 1-celled with 3–5 parietal placentas ; style simple, rarely split; ovules numerous, or 1–2 on each placenta, anatropous. Fruit an elastic capsule or baccate; seeds sometimes winged or tomentose; endosperm fleshy; embryo straight.

Species about 450. –Chiefly temperate, but also tropical.

One genus, *Alsodeia*, has to be added to Cke.'s *Flora*.

Key to genera—

I. Flowers irregular
  1. Sepals produced below their insertion ... 1. *Viola*.
  2. Sepals not produced below their insertion ... 2. *Ionidium*.
II. Flowers regular ... ... 3. *Alsodeia*.

1. VIOLA, Linn. (Cke. i, 51)

Species about 300.—Chiefly in the temperate regions of the N. Hemisphere and in S. America.

For a detailed study of the Asiatic Violas, see W. Becker, *Violæ Asiaticæ et Australenses*, Beiheft Bot. Centralbl. 36^{11} (1918), 15–59. Becker has made *Viola Stocksii*, Boiss a variety of *V. cinerea*, Boiss. As a matter of fact the two species of Boissier are so nearly related that Hooker f. and Thompson in F.B.I. i, 185, were misled to put the Sind material under *V. cinerea*, and since then nearly every Indian botanist has followed their example.

1. **Viola cinerea**, Boiss. Fl. Or. i (1867), 454, var. **Stocksii** W. Bckr.—*V. Stocksii*, Boiss. l.c. 453; Cke. i, 51; Sabnis Fl. Sind in *Journ. Ind. Bot. Soc.* (reprint) (1924), 6.—*V. cinerea*, Hook. f. and Th. in F.B.I. i, 185.

Description and *localities:* Cke. l.c.

Becker mentions a form from Kathiawar:

Forma **kathiawarensis** W. Bckr.—I have not seen it.

Two species are cultivated in gardens: *Viola tricolor*, Linn., the garden pansy, throughout the Presidency, and *V. odorata*, Linn., the sweet violet. This species is doing well at Panchgani and Mahableshwar.

2. IONIDIUM, Ventenat. (Cke. i, 52)

Species 50.—Chiefly tropical American, but also represented in Africa, Asia and Australia.

Cooke calls the only species occurring in the Presidency *Ionidium heterophyllum*, Ventenat. This name must cede to *I. suffruticosum*, Ging, as is evident from the following synonymy:

1. **Ionidium suffruticosum**, Ging in DC. Prodr. i, 311; W. Ill. t. 19: W. Ic. t. 308; F.B.I. i, 185; Grah. Cat. 11; Gamble 49; Haines 33.—*Viola suffruticosa* Linn. Sp. pl. 937; Roxb. Fl. Ind. i, 649.—*Viola enneasperma*, Linn. l.c. 937.—*Viola heterophylla*, Poir. Encycl. viii, 646.—*Ionidium heterophyllum*, Ventenat Jard. de la Malm. (1803) fol. 27 *vers;* Cke. i, 52.—*Ionidium enneaspermum*, DC.; Dalz. and Gibs. 12.—*Ionidium hexaspermum*, Dalz. in Hook. Kew Journ. iv, 342; Dalz. and Gibs. 12.—*I. leptorhizum*, DC.; W. and A. Prodr., 33.

Dunn (in Kew Bull. (1916), 63) states that two forms of this variable plant occur in the Hermann Herbarium. The bushy pubescent one was called by Linnæus *Viola suffruticosa*, the laxer and more glabrous specimen *V. enneasperma*.

Locality: Gujarat: Broach (Woodrow!).—*Khandesh* (Blatter and Hallberg!).—*S. M. Country:* Belgaum (Ritchie 675); Badami (Woodrow!); Dharwar (Cooke!).

Distribution: Bundelkhund, Agra, Bengal and southwards to Ceylon, tropical Asia, Africa and Australia.

3. ALSODEIA, Thouars.

Shrubs or small trees. Leaves alternate or rarely opposite; transverse nervules numerous, distinct and parallel; stipules rigid, deciduous. Flowers small, axillary or terminal, solitary, fascicled, cymose or racemose, regular; peduncles with many bracts. Sepals 5, almost equal, rigid. Petals 5, sessile. Stamens 5, on or within the annular disk; connective produced into a broad membranous appendage beyond the cells. Ovary 1-celled, ovoid; ovules few or many; style straight; stigma terminal. Capsule 3-valved, few-seeded. Seeds glabrous.

Species about 60.—Chiefly tropical American.

Alsodeia zeylanica, Thwaites. Enum. 21; F B.I. i. 187: Bedd. Fl. Sylv. t. 229; Talbot i, 68; Gamble 49.—*Pentaloba zeylanica,* Arn. in Mag. Zool. and Bot. ii, 543.

Description : A large shrub or small tree; young parts minutely puberulous. Leaves ovate or obovate or ovate-lanceolate, acuminate or obtuse, shining, reticulated, slightly crenate or serrate; lateral nerves 5–9 pairs, rather prominent beneath and with shallow depressed glands ciliated on their margins in the axils; blade 5·5–15 cm. by 2·5–7·5 cm; petiole 1 cm. long, channelled above; stipules 2, broadly lanceolate, rigid, 12 mm. long, deciduous. Flowers small, 3–4 mm. across, white, polygamous, in small bracteolated fascicles; pedicels 2–5 mm. long, often crowded on stout, short, recurved, scaly peduncles. Sepals ovate, acute. Petals twice as long as the sepals, recurved at the apex. Disk 5-crenate-lobed. Stamens included; filaments short, inserted on the inner edge of the disk-lobes; anthers small, yellow, sterile in the female, larger in the male flower; connective much produced and terminating in a broad-shovel-shaped reddish petaloid lobe. Ovary 3-ovuled. Capsule 3-seeded, about the size of a pea, green, reticulate, pedicelled; pedicel about 6 mm. long. Seeds white, glabrous.

This species is closely related to *A. bengalensis,* Wall., but can easily be distinguished by the characters pointed out by Hooker f. and Thompson: The branchlets are puberulous, the stipules broader, the leaves more obscurely serrulate, the flowers on shorter pedicels, the peduncles are short, stout, scaly, the petals more linear.

Locality : N. Kanara (Talbot 3809 !) ' Found in the tropical evergreen rain-forests near Katgal in the Kumpta Taluka, also on the Mulamune Ghat in North Kanara.' (Talbot).

Distribution : Forests of Malabar and Travancore up to 750 m. Ceylon.

Flowers and *fruits* at different times throughout the year (Talbot).

91. BIXACEÆ. (Hutchinson i, 159)

The family *Bixaceæ* of Bentham and Hooker's Genera Pl. i, 122, has been split up into 3 families by Hutchinson, viz. *Bixaceæ*, *Cochlospermaceæ* and *Flacourtiaceæ*. This necessitates certain changes in the general characters of the *Bixaceæ :*

Shrubs or small trees with coloured juice. Leaves alternate, simple, palminerved, stipulate. Flowers hermaphrodite, medium-sized, showy, paniculate. Sepals 5, imbricate, deciduous. Petals 5, large, imbricate, without a scale at the base; disk none. Stamens numerous, hypogynous; filaments free; anthers horseshoe-shaped, opening by short slits at the top. Ovary superior, 1-celled, with 2 parietal placentas; ovules numerous; style slender, recurved in bud; stigma 2-lobed. Fruit a densely echinate-setose or smooth capsule, 2-valved, valves thick with the placentas in the middle. Seeds obovoid; testa rather fleshy, red; endosperm copious; embryo large; cotyledons broad, incurved at the apex.

Genus 1. Species 1.—N. American, cultivated and run wild in all tropics.

1. **Bixa Orellana,** Linn. Sp. pl. (1753), 512; W. Ill. i, 17; Bedd. Fl. t. 79; Cke. i, 53; Talbot i, 72, Fig. 46.

92. COCHLOSPERMACEÆ. (Hutchinson i, 160)

Trees, shrubs or rhizomatous undershrubs with coloured juice. Leaves alternate, palmatilobed, stipulate. Flowers hermaphrodite, showy, paniculate or racemose. Sepals 5, imbricate, deciduous. Petals 5, imbricate or subcontorted. Staments numerous; filaments free, equal, or some longer than others; anthers 2-celled, linear, opening by terminal short, often confluent, pore-like slits; ovary 1-celled with parietal placentas projecting into the cell, or perfectly 3-celled; ovules numerous; style simple with minutely denticulate stigma. Fruit a 3–5-valved capsule. Seeds glabrous or covered with woolly hairs, straight or cochleate-reniform; endosperm copious; embryo conforming to the shape of the seed, large; cotyledons broad. Species about 20.—Tropics.

1. COCHLOSPERMUM, Kunth. (Cke. i, 53)

Species 15.—Tropical regions of the world.

1. **Cochlospermum Gossypium,** DC. Prodr. i (1824), 527 ; Bedd. Fl. t. 171 ; Cke. i, 53 ; Gamble 50 ; Haines 34 ; Troup Silvic. i, 12 ; Talbot i, 70, Fig. 45.

Vern. names : Kumbi, Gabdi, Gejra (Hind.), Ganglay, Galgal (Mar.), Buruga, Bulauri (Kan.).

Description and *localities :* Cke. l. c.

Distribution : Garwal, Bundelkhund, Bihar, Orissa, Bengal, Burma, C. India, Deccan, W. Peninsula, Madras Presidency in dry forests, especially on stony hills, in all districts, but less common on the W. Coast.

Uses : The wood soaked in water for about eight hours and the water strained off, mixed with flour and fried, forms a nutritious food in the Sambalpur District (*ex* Haines). The wood is also used for torches, but otherwise it is considered to be useless for economic purposes.

The tree yields a clear white gum, called Kuteera gum. It is insoluble in water and used in the book-binding and shoe-making trades. The gum is also employed as a substitute for Tragacanth. For details see Ewing, C. O. Karaya gum, a substitute for Tragacanth, in *Journ. Amer. Pharm. Assoc.* vol. vii (1918), 787–90.

According to Talbot the floss from the seeds makes a good stuffing for pillows, even better than that from *Bombax*. Gamble says that the cotton of the seeds is but little used. See however *Correa Mendes*, F. C., *A. panheira,* in *Bol. Agric. Nova Goa* 1 (1919), 37–44.

From the bark a cordage fibre is obtained. See Crevost, C. et C. Lemarie. Plantes et produits filamenteux et textiles de l'Indo-Chine, in *Bull. Econ. Indo-Chine* 22(1919), 365–401, 553–591.

93. FLACOURTIACEÆ. (Hutchinson i, 161)

Trees or shrubs. Leaves simple, alternate ; stipules often soon falling off. Flowers hermaphrodite or unisexual, often dioecious or polygamous, variously arranged. Sepals sometimes not distinguishable from the petals, imbricate or open in bud. Petals sometimes not arranged regularly in relation to the sepals, large, small or absent, with or without an opposite scale inside the base, imbricate. Stamens numerous, rarely few, hypogynous, free ; anthers 2-celled, often short, opening lengthwise by slits. Ovary 1-celled with 1 or more parietal placentas or rarely the placentas meeting in the middle ; ovules 2 or more on each placenta ; styles or stigmas as many as the placentas. Fruit indehiscent, mostly a berry or drupe, very rarely a capsule, sometimes large. Seeds with fleshy endosperm and medium-sized embryo ; cotyledons often broad.[1]

Species about 630.—Mainly tropical.

Key to genera—

- I. Flowers bisexual ... ... 1. *Scolopia.*
- II. Flowers dioecious—
  - 1. Petals 0 ... ... 2. *Flacourtia.*
  - 2. Petals 5 ... ... 3. *Hydnocarpus.*

1. SCOLOPIA, Schreb. (Cke. i, 54)

Species 30.—Tropics of the Old World.[2]

Scolopia crenata, Clos. in Ann. Sc. Nat. ser. 4, 8 (1857), 250 ; Bedd. Fl. t. 78 ; Cke. i, 54 ; Gamble 53 ; Talbot i, 73, Fig. 47. *Phoberos crenatus, lanceolatus et Wightianus,* W. and A. Prodr. 29–30.

Description and *localities* : Cke. l. c.

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[1] Cf. Gilg, E. Die bis jetzt aus Neu Guinea bekannt gewordenen Flacourtiaceen. *Bot. Jahrb.* 55 (1918), 273–94.

Van Slooten, D.F. Bijdrage tot de Kennis der Combretaceen en Flacourtiacen van Nederlandsch Indie. *Utrecht,* 1919, p. 170.

Van Slooten, D.F. The Flacourtiaceæ of the Dutch East Indies, *Bull. Jard. Bot. Buitenz*, iii, 7 (1925), 291-421, Fig. 1–15.

[2] Cf. Phillips, E.P. The thorn pears (*Scolopia spp.*). *Bothalia,* 1 (1922), 83–86.

Distribution: I found this tree at Mount Abu. It occurs in the W. Ghats from the Konkan southwards, in the Nilgherry scholas, and Ceylon, the higher hills of Cuddapah, Chingleput and Salem, China and Philippines.

Flowers: March.

Fruit: Ripe in August.

Uses. The wood is reddish brown or white, and very hard.

2. Flacourtia, Commers. (Cke. i, 54)

I give a more comprehensive description of the genus: Trees or shrubs, often thorny. Leaves shortly petioled, toothed or crenate, 3-5-nerved at the base. Flowers small, dioecious, rarely bisexual. Sepals 4-5, imbricate. Petals 0. Stamens many, sometimes surrounded by glands; anthers short, versatile. Ovary 2-5-celled on an annulate or lobed disk, or disk represented by separate glands; styles 2-11, separate or connate at the base or 0; stigmas notched, 2-lobed or, in the absence of styles, capitate; ovules usually in pairs on each placenta. Fruit indehiscent; endocarp hard, with as many cells as seeds, or separating into 1-seeded stones. Seeds obovoid; testa thinly coriaceous; cotyledons orbicular.

Species 15.—Warmer parts of Africa and Asia and adjacent islands.

In the following I remove *Flacourtia Cataphracta*, Roxb. from the Bombay Flora, raise the variety *occidentalis* of *F. Ramontchi* to the rank of a species, and add F. *inermis*, Roxb. as a cultivated species.

The exclusion of *F. Cataphracta* scarcely requires an explanation. Cooke included it on the authority of Dalzell and Gibson (Bomb. Fl. 10) who state that it had been found in the Wari country on the banks of rivers. Since then it has not been found by any collector. The distribution of the species does not speak in favour of its presence in the Bombay Presidency. It spreads from Assam and Lower Bengal to Chittagong, Malacca, Singapore, and eastwards, and from Orissa to the E. Ghats of Vizagapatam District. It has, except by Dalzell and Gibson, never been reported from the W. Peninsula.

F. Ramontchi has undergone many vicissitudes since it was described in 1784. Hooker f. and Thomson (F.B.I. i, 193) confessed that they were 'quite unable to define the various forms brought together under the names of *F. Ramontchi* and *sapida*, and which include either several species, or one that spreads all over India, and varies much, presenting however the following varieties or species.' They mention vars. *Ramontchi proper*, *sapida*, *latifolia*, *occidentalis* and *racemulifera*.—Cooke (i, 55-56) retained var. *sapida*, and var. *occidentalis* and made var. *latifolia* a distinct species *F. latifolia*, T. Cooke.—Talbot (i, 76-78) has the varieties *sapida*, *latifolia* and *occidentalis*.—Gamble (p. 54) identifies var. *sapida* (*F. sapida*, Roxb.) with the type, and so does Troup (Silvic. i, 12).—Haines (p.37) drops all the varieties, but retains the names of *Ramontchi* proper, *sapida* and *occidentalis* as indicating so many forms. Haines follows Cooke in considering *F. latifolia* as a distinct species, but I am afraid that his *F. latifolia* is a different plant. He himself is not quite sure about the identity because the size of the fruit in Cooke's species is that of a pea, whilst the fruit of the Orissa plant measures 15 mm. in diameter.

As will be seen below I have merged Roxburgh's *F. sapida* in *F. Ramontchi*. As to *F. latifolia* I follow Cooke and the variety *occidentalis* has been made a species

Key to species—

I. Thorns present—
  1. Thorns not bearing flowers—
    (*a*) Fruit size of a cherry ... ... 1. *F. montana*.
    (*b*) Fruit size of a pea
      * Branchlets and young parts not velvety-tomentose
        @ Stigmas 5-11 ... ... 2. *F. Ramontchi*.
        @@ Stigmas 3-4 ... ... 3. *F. latifolia*.
      ** Branchlets and young parts velvety-tomentose ... ... 4. *F. occidentalis*.
  2. Thorns bearing flowers ... ... 5. *F. sepiaria*
II. Thorns absent ... ... 6. *F. inermis*.

1. **Flacourtia montana,** Grah. Cat. Bomb. Pl. (1839) ; Cke. i, 55 ; Talbot i, 76, Fig. 48 ; Gamble 54.

Vern. names : Han Sampige, Gudda (Kan.), Attack, Champer, Champari (Mar.).

Description : A middle-sized or large tree ; trunk and branches thorny, thorns 5–8 cm. long. Leaves ovate, elliptic-lanceolate, acuminate or obtusely abruptly acuminate, crenate, coriaceous, glabrous and shining above, glabrate beneath (hairy when young), base acute or rounded, 3–5-nerved from the base, and with a few pairs of lateral nerves ; midrib tomentose ; blade 10–19 cm. by 3·5–7·5 cm. ; petioles 8 mm. long. Flowers small, in short densely pubescent racemes fascicled in the axils of the leaves. Male flowers : Sepals tomentose. Stamens with filaments 5 mm. long. Female flowers : Sepals rusty-tomentose. Ovary urn-shaped, glabrous ; styles 5, reflexed, notched at the apex. Fruit globose, the size of a cherry, obtusely ribbed, red or purple (Talbot) or scarlet (Cooke), about 6-seeded ; pedicels very short ; seeds compressed, hard, woody, rough, in 2 distinct rows.

Localities : Konkan (Law, Stocks) ; Bombay (Dalzell) ; Matheran (Herb. S.X.C. 18195 !).—*Kanara :* Deomun Ghat (Herb. S.X.C. 18194 !) ; tropical evergreen forests (Talbot).

Distribution : Konkan and N. Kanara ; in the Madras Presidency in the forests of the W. Coast and W. Ghats up to 900 m. (Gamble). We found it on the High Wavy Mountains, 1800 m.

Flowers : Cold season.

Fruits : February 1893 (Kanara).

Uses : The wood which weighs 50 lbs. to the cubic foot is used for building purposes in N. Kanara (Talbot). The fruit is edible ; it has an agreeable flavour and makes good jelly.

2. **Flacourtia Ramontchi,** L'Hérit. Stirp. (1784), 59, tt. 30, 30B ; W. Ic. t. 85 ; F.B.I. i, 193 (*partim*) ; Brandis For. Fl. 18 ; Cooke i. 55 (*partim*) ; Talbot i. 76 (*partim*) ; Gamble 54 ; Parker 22 ; Haines 37 (*partim*). *F. sapida,* Roxb. Cor. Pl. i. t. 69 ; Fl. Ind. iii. 835 ; W. and A. Prodr. 29 ; Wall. Cat. 6675 C ; Collett Fl. Siml. 41, Fig. 13.—*F. Ramontchi,* var. *sapida* Hook. f. and Th. in F.B.I. i, 193 ; Cke. i, 55.—*F. Ramontchi forma sapida,* Haines, in Haines 37. *F. Ramontchi* var. *Ramontchi* proper, Hook. f. and Th. l. c. 193.

I am aware that Merrill calls the above species *Flacourtia indica*. Owing to the kindness of Mr. C. E. C. Fischer of the Kew Herbarium I am able to quote the following extract from 'An Interpretation of Rumphius's *Herbarium Amboinense* by G.E.D. Merrill' (1917), p. 377 :

Flacourtia indica (Burm. f.) *comb. nov.*

Gmelina indica, Burm. f. Fl. Ind. (1768), 132, t. 39, f. 5.

Mespilus sylvestris, Burm. Index Univ. Herb. Amb. 7 (1755) [18] (type !), *non* Burm. l c. [14].

Flacourtia sepiaria Roxb. Pl. Coromandel. 1 (1795), 48, t. 68.

Flacourtia ramontchi, L'Hérit. Stirp. Nov. (1784–5), 59, t. 30, 31.

Spina spinarum, i, *mas*, Rumph. Herb. Amb. 7, 36, t. 18, f. 1, 2.

Spina spinarum, ii, *femina*, Rumph. l. c. 37.

'This species is not represented in our Amboina collections. Rumphius states, however, that the plant was an introduced one there, originating in Java, where it was common. *Spina spinarum*, Rumph. is the whole basis of *Mespilus sylvestris*, Burm., as published on page 18 of his Index Universalis ; it is not included in the Index Kewensis. The name is invalid, however, because Burman published the same binomial on page 14 of the same work for an entirely different species, *Carissa carandas*, Linn. (see p. 425). I consider that the form figured and described by Rumphius is the same as *Flacourtia sepiaria*, Roxb., from which I cannot distinguish *F. ramontchi*, L'Hérit. Linnæus cites the first figure as a synonym of *Carissa spinarum*, Linn., but the plant actually described and hence the type of the species is a true *Carissa :* Figure 3 of the same plate, the type of *Mespilus sylvestris*, Burm., Index Universalis [14] non [18], is apparently a true *Carissa.* Linnæus, in his erroneous reduction of *Spina spinarum*, Rumph., was followed by Murray, Lamarck, Wildenow, Roemer and Schultes, Dietrich and Pritzel. Loureiro, Fl. Cochinch. (1790), 634, cites the Rumphian species under *Stigmarota jangomas*, Lour = *Flacourtia, jangomas* (Lour.) Steud. By other authors it has been referred to *Damnacanthus indicus*, Gærtn., of the *Rubiaceæ* ; to

Flacourtia jangomas, Steud.; to *Roumea sp.* = *Flacourtia*; and to *Flacourtia cataphracta*, Roxb. It is possible that *Spina spinarum*, ii. *femina*, Rumph. represents a species different from *Spina spinarum*, i, *mas*. Burman's *Gmelina indica* supplies the oldest valid specific name for the species and is here adopted. Burman's type was from Java, for which he cites the Javanese name doery roekan.'

So far Merrill. I have not got the material and literature which he used at my disposal; I can only consider his statements. He says: '*Spina spinarum*, Rumph., is the whole basis of *Mespilus sylvestris*, Burm., as published on page 18,' and later on: 'I consider that the form figured and described by Rumphius is the same as *Flacourtia sepiaria*, Roxb.' From this it follows that *Spina spinarum*, Rumph., *Mespilus sylvestris*, Burm. and *Flacourtia sepiaria*, Roxb. are different names for the same plant. But here the all-important question arises: What plant has Merrill in mind when he speaks of *Flacourtia sepiaria*, Roxb.? It cannot be the real *Flacourtia sepiaria*, Roxb., because he cannot distinguish *Flacourtia ramontchi*, from it.

Now botanists may be divided in their opinion regarding a number of so-called species of *Flacourtia*, but, as far as I know, nobody has ever affirmed that *F. sepiaria*, is not a good species. Not even Hooker f. who took a wider view of the species has made an attempt to combine *F. ramontchi* with *F. sepiaria*. Nobody who has seen specimens of the two species in their natural habitats has thought for a moment that they belong to the same species, whatever the delimitation of *F. ramontchi* may be.

The same difficulty is felt when Merrill says that Burman's *Gmelina indica*, supplies the oldest valid specific name for the species. To which species of *Flacourtia*, does the plant belong which he considered to be identical with *Gmelia indica?* To this we cannot receive a satisfactory answer because for Merrill there is no specific difference between *F. sepiaria*, and *F. ramontchi*. It is my impression that Merrill had no good specimen of *F. ramontchi*, at hand and that this fact is to blame for the mistake.—Until this question is cleared up I prefer to adhere to the names *F. ramontchi* and *F. sepiaria*.

Vern. names: Paker, Kaker, Bhekal (Mar.), Kanju (H.), Hunmunki, Hanumanth, Bhably (Kan.), Bhokakai (Bhil).

Description: A shrub or small tree, deciduous, armed with axillary thorns, and often with tufts of branched thorns on the stem Leaves variable, 2-9 cm. by 2-5 cm., ovate, broadly elliptic, obovate or suborbicular, crenate or serrate, apex acute or acuminate or rounded, glabrous or pubescent above, more or less pubescent beneath; petiole 5-8 mm. long. Flowers greenish yellow, dioecious, in short simple or branched usually tomentose racemes. Sepals 4-5, about 2 mm. long, ovate or orbicular, hispid and ciliate, imbricate. Petals 0. Stamens numerous; anthers small, versatile, opening by slits. Ovary on a glandular disk; stigmas 5-11, free or connate. Fruit 8-12 mm. in diameter, globose, red or dark-brown or dark purple; endocarp hard with as many cells as seeds. Seeds 8-16.

Note.—'A shrub with small leaves in the scrub forests and on rock hills, a small tree with rather large leaves in the larger forests.' (Gamble).

Localities: Khandesh: Turanmal (Blatter and McCann 27176! 27357!).—*Konkan:* (Law, Stocks); 18 miles south of Mahableshwar (Acland!).—*Deccan:* Sakarpathar near Lonavla (Herb. S. X. C. 18201!); Igatpuri (McCann 17656!).—*S. M. Country:* Belgaum (Ritchie 982).

Distribution: Sub-Himalayan tract and Outer Himalaya, ascending to 1200 m. from the Indus eastwards and in the adjacent plains, Upper Gangetic Plain, common in the Peninsula, W. Ghats, forests of the N. Circars and Deccan up to 900 m. Burma in indaing and in dry forests.

Uses: The fine-grained wood is used in turnery, for combs, etc. Fruit edible, eaten by birds. The twigs and leaves are used as fodder.

3. **Flacourtia latifolia,** T. Cooke in Cke. i. 56. *F. Ramontchi* var. *latifolia* Hook. f. and Th. in F.B.I. i, 193.

Description: Cke. l.c.

Localities: Deccan: Mahableshwar (Cooke! Acland! M. Ezechiel!); Panchgani (Blatter 18199!); Purandhar (Blatter and McCann 17662!), Igatpuri (Blatter and McCann 17657!); Khandalla (Blatter 18196! 18200!).—*S. M. Country:* Near Belgaum (Ritchie 189).

Distribution : Mount Abu, W. Ghats, Carnatic, Nilgherries.
Flowers : March 1917 and April 1891 (Mahableshwar).
Fruits : May 1921 (Mahableshwar).

4. **Flacourtia occidentalis**, Blatter, *spec. nova.—F. ramontchi*, L'Hérit. var. *occidentalis* Hook. f. and Th. in F.B.I. i, 193 ; Cke. i, 56 ; Talbot i, 77, Fig. 51 ; Duthie Fl. Upp. Gang. Pl. i, 59.—*F. ramontchi* forma *occidentalis* Haines in Haines 37.

Tota planta plus minusve velutina vel tomentosa. Spinæ tenues, noncurvatæ. Sepala ovata, ciliata.

Distinguitur a F. Ramontchi ramulis, foliis, petiolis necnon inflorescentia permanenter plus minusve velutinis vel tomentosis, spinis tenuibus.

Description : A small tree ; whole plant more or less covered with permanent grey velvety tomentum ; bark grey, scaly, thin. Spines slender, straight. Leaves 3–8 by 2–5 cm., broadly oblong, oblong-elliptic, orbicular or obovate or lanceolate, rarely elliptic or ovate, crenate or serrate, base rounded, cuneate or cordate, rounded or acute at the apex, more or less tomentose ; petioles tomentose or velvety. Racemes tomentose. Sepals ovate, ciliate. Styles about 5, distinct, reflexed, and 2-divided at the apex.

Localities : Khandesh : Turanmal (Blatter and McCann 27283 !).—*Konkan :* (Gibson, Stocks).—*Deccan :* Khandalla (Blatter 18189 !).

Distribution : Baluchistan, Outer Himalaya up to 1200 m., Punjab, Upper Gangetic Plain, Mount Abu, Central India, Chota Nagpur, Bihar, Deccan, Khandesh, Konkan.

Flowers : November to March.

Fruits : February to August.

Uses : The wood is hard and durable, but splits. It is used for agricultural implements. The fruit is eaten, either raw or cooked. The leaves are cattle-fodder. Native medicine makes use of the gum and powdered bark. (Talbot).

5. **Flacourtia sepiaria**, Roxb. Cor. Pl. i (1795), 48 t. 68 ; Fl. Ind. iii, 835 ; Royle Ill. 73 ; F.B.I. i, 194 ; Cke. i, 56 ; Talbot 78 ; Gamble 54 ; Haines 36.—*F. obcordata*, Roxb. Fl. Ind. iii, 835.—*Sideroxylon spinosum*, Willd. Sp. Pl. i, 1091. Rheede Hort. Malab. v, t. 39.

Description : A very thorny small rigid bush ; thorns straight, sharp, up to 5 cm. long, sometimes branched, many of them bearing clusters of leaves and flowers, and longer than the leaves ; twigs pubescent. Leaves on the young shoots alternate, on the older fascicled, small, 2–3·5 cm. by 12 mm., very rarely 2·5–7 cm. in luxuriant plants, elliptic, obovate or obcordate, or orbicular, rarely oblong or oblanceolate, cuneate or narrowed at the base or cordate, more or less crenate-serrate except at the base, glabrous, stiff ; secondary nerves 3–4, reticulate between ; petioles 3–6 mm. long, often pubescent. Flowers dioecious, small, axillary, greenish, solitary at the ends of the short shoots or in racemose clusters shorter than the leaves. Male sepals ovate, obtuse. Female flowers on pedicels up to 5 mm. long, sepals orbicular. Styles 3-7, stigmas bilobed. Berry globular, smooth, reddish, turning dark-coloured when ripe, with about 6–10 mm. in diameter ; pyrenes angular, rugose ; testa smooth. Cotyledons broadly orbicular, base somewhat cordate ; radicle excluded, straight.

Localities : Khandesh : Bor, on sandy mud of Tapti River (Blatter and Hallberg 18198 !).—*Konkan :* Hilly parts (Graham).—*Deccan :* Khandalla (Blatter 18197 !).—*S. M. Country :* Dharwar (Cooke f).—*N. Kanara :* Stony ground near coast (Talbot).

Distribution : Kumaon, dry jungles throughout Bengal, Bihar, Orissa, Upper Burma, Andamans, the W. Peninsula, scrub forests in all districts of the Madras Presidency, especially on the Coromandel Coast and in the Deccan.

Flowers : Cold season.

Fruits : Rainy season.

Uses : Leaves, root and bark used in medicine. The fruit is eaten. The leaves are used as fodder.

var. **integrifolia** var. nov.—*Foliis integerrimis.*
Locality : Igatpuri (McCann 17666 !).

6. **Flacourtia inermis**, Roxb. Cor. Pl. iii, 16, t. 222 ; Fl. Ind. iii, 833.

Description : Unarmed, young branches puberulous. Leaves ovate or oblong—lanceolate, acute or acuminate, base acute or rounded, 10–20 cm. by

5–9 cm., obtusely serrate, shining, thin, coriaceous, glabrous, midrib below pubescent; petiole 8–12 mm. long. Flowers bisexual in fascicled pubescent racemes. Stigmas 4–8, 2-lobed. Disk covered with fleshy orange glands. Ovary 5-celled; cells 2-ovuled. Fruit size of a cherry, red acid; pyrenes 8–10.

Locality: Bombay Island (Blatter!). Introduced.

Distribution: Singapore, Penang, Sumatra. Cultivated in India.

3. HYDNOCARPUS, Gaertn. (Cke. i, 56)

Species 30.—Indo-Malayan.

1. **Hydnocarpus Wightiana**, Blume Rumph. iv (1848), 22 ; Cke. i, 57; Talbot i, 79, Fig. 53; Gamble 52 . —*H. inebrians*, Wall. Cat. 6670; W. Ill. t. 16

Vern. names: Kastel, Kantel, Kiti, Kabasale, Kawti (Mar.), Toratti, Surti (Kan.), Kudre, Sulte.

Description: Cke. 1 c.

Localities: Konkan: Bombay (Blatter!); Vingorla (Ritchie), near Goa (Stocks).—*S. M. Country*: Castlerock (V. K. Vaidya 18203!).—*N. Kanara;* Karwar (T. R. Bell 4074!); Yellapur, evergreen forests (Sedgwick 2434!); Sulgeri (T. R. Bell 3869!); Kadra (T. R. Bell 3910!); Gund (T. R. Bell 6009!).

Distribution: Endemic in tropical forests along the W. Ghats from the Konkan southwards and below the Ghats in Kanara and Malabar in damp situations, especially near water. Common in Travancore up to 600 m.

Flowers: April 1918 (N. Kanara), May 1919 (N. Kanara).

Fruits: June 1918 (Karwar), May 1917 (Yellapur).

Uses: Used for beams and rafters in N. Kanara. The seeds yield a yellow oil (chalmogra) used for burning and against skin diseases, also administered internally. (Talbot).

94. SAMYDACEÆ.

1. CASEARIA, Jacq.

Species 80.—Warmer parts of the world, chiefly in America.

1. **Casearia graveolens,** Dalz. in Kew Journ. Bot. 4 (1852), 107; F.B.I. i, 592; Cke. i, 520; Gamble 520; Parker 256 (*partim*); Haines 39.—*C. glomerata* Brandis, Ind. Trees 343 (*partim, non* Roxb.); Talbot i, 69 (*partim*); Troup ii, 611 (*partim*).

Clarke in F.B.I. l.c. keeps *G. graveolens*, Dalz. separate from *C. glomerata* Roxb. It was Brandis in his Indian Trees l.c. who united them under *C. glomerata*, and Talbot, Parker and Troup followed him. Gamble [Kew Bull. (1920), 56] calls the Madras plant *C. graveolens*. 'I cannot agree,' he says, 'with Sir Dietrich Brandis (*Indian Trees*, p. 343) in combining *C. glomerata*, Roxb. and *C. graveolens*, Dalz. The latter is a very widespread small tree of low levels in Northern India, deciduous and with its leaves turning red before they fall, and is, I think, very distinct from the tall, apparently evergreen, *C. glomerata* of the Sikkim forests, about 7,000 feet.'

Clarke had pointed out before that *C. graveolens* is to be separated from *C. glomerata* by the pedicel glabrous above its articulation and by its geographic locality. *C. glomerata* has been collected in Sikkim, Bhotan and Khasia, 900–1,500 m. Gamble (Man. Ind. Timb.) describes *C. glomerata* as a large evergreen tree of the Eastern Himalaya, Khasi Hills, Sylhet, and hills of Upper Burma.

Vern. names: Bhokhara, Bokhada (Mar.).

Description: Cke. l.c.—At the time of flowering the tree is nearly or quite leafless. Old leaves turn copper-coloured in the cold season.

Localities: Khandesh: Jalgaon (Blatter!); Akrani (Blatter and Hallberg!).—*Konkan:* Open hills of the S. Konkan (Dalzell); Matheran (Cooke! D'Almeida!)—*Deccan:* Mawal, Poona Distr. (Woodrow!); hills near Kadkala (Kanitkar!); Panchgani (Blatter!); Fitzgerald Ghat below Mahableshwar (Cooke!).

Distribution: Gurwhal, Kumaon, Sikkim, Bihar, Orissa, N. Circars, in Ganjam, chiefly on old cultivated lands, Konkan and Deccan Ghats, in open situations.

Uses : The wood which is light-yellow, moderately hard and even grained, is suitable for carving plates, etc. (Gamble). The fruit is used for poisoning fish. (Talbot)

2. **Casearia esculenta,** Roxb. Fl. Ind. i (1832), 422; Cke. i, 520, but exclude syn. *Casearia varians*, Thw. Enum. 19 and Bedd. Fl. Sylv. t. 208. The same applies to F.B.I., Talbot and others who followed the F.B.I.

I exclude *C. varians*, Thw. on account of the following remark made by Gamble in Kew Bull. (1920), 56: 'I have been much puzzled to identify the species figured by Beddome (*Flora Sylvatica*, t. 208) as *C. varians*, Thw., and coming from the ' dense moist forests of the W. Ghats at 2,000-3,000 ft. elevation.' The figure does not agree with *C. esculenta*, Roxb., as Clarke and Bourdillon have identified it, nor entirely, though nearer, with *C. rubescens*, Dalz. There are two specimens in the Kew Herbarium, collected by Bourdillon (1) No. 181 from evergreen forests at Peermeri, 3,500 ft., which I think, is a form of *C. rubescens* with more lanceolate leaves than the Bombay plant; and (2). No. 104 from evergreen forests near Colatoorpolay, which is, I believe, the plant of Beddome's figure. I have, therefore, assumed it to be so, and, pending the possibility of examining more and better specimens, I am calling it *C. varians*, Bedd. not of Thw.'

Vern. names : Mori, Modi, Kulkulta, Pate (Mar.).

Description : Cke. i, 520.—The tree is apparently evergreen.

Localities : Cke. 1. c.

Distribution : W. Peninsula from Bombay to Coorg; throughout the moist monsoon-forests of the Konkan and N. Kanara, common on the hills near Karwar, S. Kanara to Cochin; E. Coast, in the Circars and southwards; Striharikota and similar forests of the Carnatic.

Flowers : May to June.

Fruits : August to September.

Uses : Wood and leaves are used medicinally (Talbot).

3. **Casearia tomentosa,** Roxb. Fl. Ind. ii (1832), 421; Brandis For. Fl. t. 31; Cke. i, 521; Talbot ii, 71, Fig. 330; Gamble 521; Haines 39.—*C. elliptica* Willd.; W. Ic. t.—1849.

Vern. names : Chilla, Bheri (Hind.), Modi, Modgi (Mar.), Tordul (Bhil). Bilioobina (Kan.).

Description : Cke. l. c.

Localities : Konkan : Bassein (Blatter!); Vingorla (Stocks).—*Deccan :* Hills near Poona (Bhiva).—*S.M. Country :* Belgaum (Ritchie 1011).

Distribution : Sub-Himalayan tract in the Punjab from the Indus eastwards, Oudh, Bihar, Orissa, Bengal, Central and S. India, W. India from Bombay southwards in deciduous forests, Circars, Carnatic.

Flowers : January to May.

Fruits : Hot and rainy season.

Uses : Wood used for carving (Talbot), also for making combs (Brandis). The bark is bitter and is sometimes mixed with ' kamela ' powder. The pounded fruit is used for poisoning fish (Talbot). In Bihar and Orissa the fruits pounded with mud, are thrown into dammed-up streams for killing fish. The pounded bark is applied externally in dropsy, fever and snake-bite. (Haines).

4. **Casearia rubescens,** Dalz. in Kew Journ. Bot. 4 (1872), 108; F.B.I. i, 593; Cke, i, 521; Talbot ii, 71; Gamble 520.

I am retaining this species though Cooke himself was ' quite unable to separate this from *C. graveolens* except by assuming Dalzell's description to be correct, viz. that it is a shrub 4-6 feet high.' Even Dalzell who founded the species was doubtful of its being a good one. Talbot, l.c., remarks: ' A large shrub or small tree scarcely more than a variety of *C. glomerata*, Roxb.'

In my opinion *C. rubescens* is sufficiently distinguished from *C. graveolens* so as to justify its being considered a separate species. *C. rubescens* has entire leaves, minute scale-like stipules, pubescent pedicels, a glabrous calyx, pubescent filaments and a style almost 0.

Description : Cke. and Talbot 11. cc.—Tabot calls it a large shrub or small tree.—According to Gamble it is an apparently evergreen shrub, whilst Talbot calls it deciduous.—The glabrous branchlets have large lenticels.

Localities : Cke. l. c.
Distribution : W. Ghats, in the forests of Coorg, hills of Travancore, 1000 m.
Flowers : Cold season.
Fruits : Hot season.

2. HOMALIUM, Jacq. (Cke. i, 521)

Species 80.—Hot regions of nearly the whole world.

1. **Homalium zeylanicum,** Benth. in Journ. Linn. Soc. 4 (1860), 35; Cke. i. 522; Talbot ii 72, Fig. 331; Gamble 525.—*Blackwellia tetrandra*, W. Ic. t. 1851.
Description : Cke. l.c.—The tree is evergreen, the young leaves are bright red and the flowers fragrant.
Localities : Cke. l.c.
Distribution : W. Peninsula. From the Konkan southwards, rain-forests of the northern ghats of N. Kanara, evergreen forests of Malabar up to 1200 m : moister parts of Ceylon up to 900 m.

(*To be continued*).

IMPRESSIONS OF PACHMARHI BIRDS

BY

CAPT. R. S. P. BATES

(*With 4 Plates*)

From Victoria Terminus onwards the eye of the traveller is attracted to large and glaring posters extolling the beauties of Pachmarhi, and one gathers from these same monstrosities that Pachmarhi is a golfers' paradise alone. The park-like links are undoubtedly beautiful, but not being a follower of the little white ball I had perforce to look around for other attractions, and they were indeed many—Bee-dam, Pathar-chatta, and Waters' Meet for the would-be channel swimmer; Monte Rosa, the crags of Dhupgarh, and many other khuds for the climber ; rides galore and polo for the horseman ; many miles of good roads for the motorist ; and last, but not least, glorious walks through lovely woods and dales for those with no means of transport but their own feet.

The scenes and scenery conjured up in one's mind by the contemplation of this galaxy of pursuits led one to hope that one had struck a good spot for one's own particular failing, namely the photography of birds. Unfortunately not leave but the horrors of a combined course at the Small Arms School had brought us to this C. P. hill-station, and consequently from our arrival on April 9th, till the end of June one enjoyed little leisure for the indulgence of one's hobby. I could therefore do little beyond make daily notes of the birds I saw during the first three months of our stay and this was unfortunate as many birds to be found on the plateau were only breeding during those first days. The rains also commenced just at the end of the course—in these hills they are very heavy too—so, even when I was indulging in six weeks' privilege leave after my labours, I still had few opportunities of using my hiding tent.

In vol. xxviii, No. 2 of this journal is a most excellent list of the birds of Pachmarhi compiled by Mr. Osmaston, and this list I found of the greatest help. It contains 131 names, of which I noted 99, but of course a number of the remainder are purely winter visitors with which I had no hope of meeting. I did however come across nine other birds which are not down in his list. However I had better start at the beginning.

To my mind as far as the birds are concerned, Pachmarhi may be divided into three zones. There are of course no definite boundaries to these, though certain birds common in one zone are rare and occasionally even wanting in the others. These zones are namely the plateau and ridges on it, which are dry and waterless except in the monsoon ; the ravines running down from the plateau which contain the perennial streams ; and thirdly the higher hills which surround the plateau and have a somewhat different flora. I intend to deal with the plateau birds to begin with, as these the visitor will probably strike first.

I arrived in Pachmarhi on April 9th, and it was not long before it struck me that, though the plateau undoubtedly teemed with bird-life, the number of species was not very great. At that time five birds, not counting house sparrows and mynas, were breeding freely, namely the Yellow-throated Sparrow, the Chestnut-bellied Nuthatch, the Common Indian Bee-eater, the Indian Purple Sunbird, and the Small Minivet ; the first and third in very large numbers.

The Yellow-throated Sparrows were in possession of the majority of the holes and crevices to be found in many of the trees, but their nesting is not of particular interest whereas that of the Nuthatch is. The first nest of the latter species I remarked was some thirty feet up in a cavity in a very large banyan tree. The cleft was more or less diamond-shaped, four or five inches long, and about three inches wide, and this the Nuthatch had cemented up until nothing remained but a very neat round hole. I shared the discovery of this nest with a tree-pie which had also been watching the antics of the little birds and flew to the hole to investigate just as one of them left. There were young ones in the nest as I could hear their shouts of hunger quite clearly from the ground. The Nuthatches' excellent architecture saved their offspring, as the tree-pie was quite unable to get even its head into the hole which I judged to be little more than an inch in diameter. These magpies are excessively common both on and below the plateau and must account for large numbers of eggs and young birds. It was not until after the end of June that I had time to search for tree-pies' nests however, and then I could only find abodes which were obviously finished with. Nuthatches are not very shy birds and will allow of observation at the nest. After the breeding season they are to be met with in parties, energetically flying from tree to tree searching trunk or branches, clambering either upwards or downwards, first on one side, then slithering round to the other. While feeding thus, they will often allow one to approach to within two or three yards. They are by no means silent, and one is always apprised of their whereabouts by a series of squeaks. By the end of May nidification is undoubtedly at an end.

Indian purple sunbirds are also very common and during April and May nesting is in full swing. On my way to parade—I had about a mile to go to reach the school—I used to pass no fewer than five nests. One was suspended from a rose-bush trained along the edge of the verandah, three were hanging from strands of lantana in deep ditches and one, about eight feet from the ground, was in a prickly bush of some sort overhanging the road and within a couple of feet of a not-at-home box. Three of these nests were destroyed while still holding eggs, in all probability by tree pies.

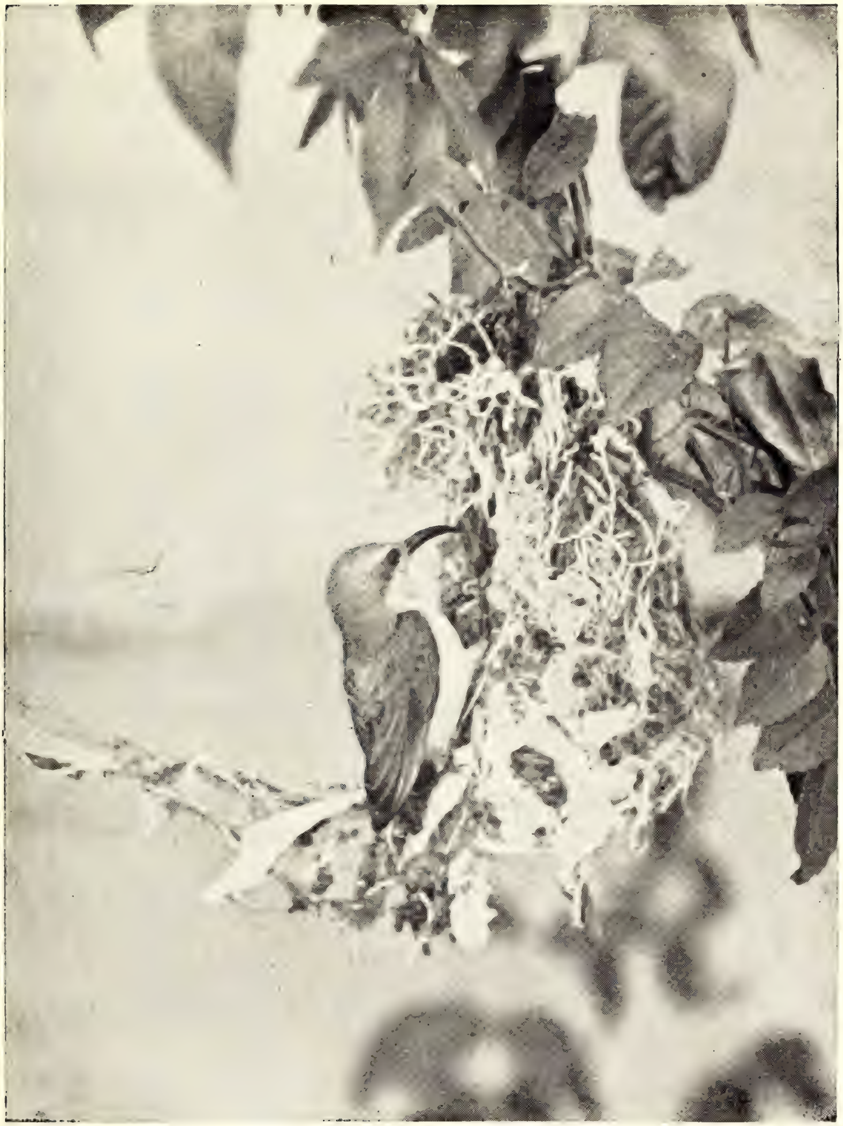
When first spotted, the one on the verandah already contained two eggs. This was April 10th. On the 21st I discovered that both eggs were hatched, and the young ones left the nest fourteen days afterwards, i.e. on May 5th; one before breakfast, the other sometime during the course of the morning. The female was very tame indeed and did not mind coming to the nest even when I was leaning against the verandah rails but a yard distant, but the male's disposition was very different and I had to wait by the camera for over an hour to get one photograph, and this did not turn out as well as I hoped as just as I pressed the release he popped his head into the entrance hole.

On May 26th, a Sunbird's nest was started in a small tree opposite my bedroom door, possibly by the pair I have just been talking about. In vol. xxxi, No. 2, I described how a sunbird took no less than twenty-one days in which to build. This one was amazingly quick and though it built its nest in exactly the same way, that is, by completing a flimsy outer casing first, within six days the structure was finished. The outer shell was made in three days; i.e. the first day saw a stalk about two inches long; on the second this was lengthened and shaped into the upper half complete with the entrance hole; and the third saw it finished. On May 3rd, the female was sitting in real earnest, but a couple of days later the whole nest had disappeared.

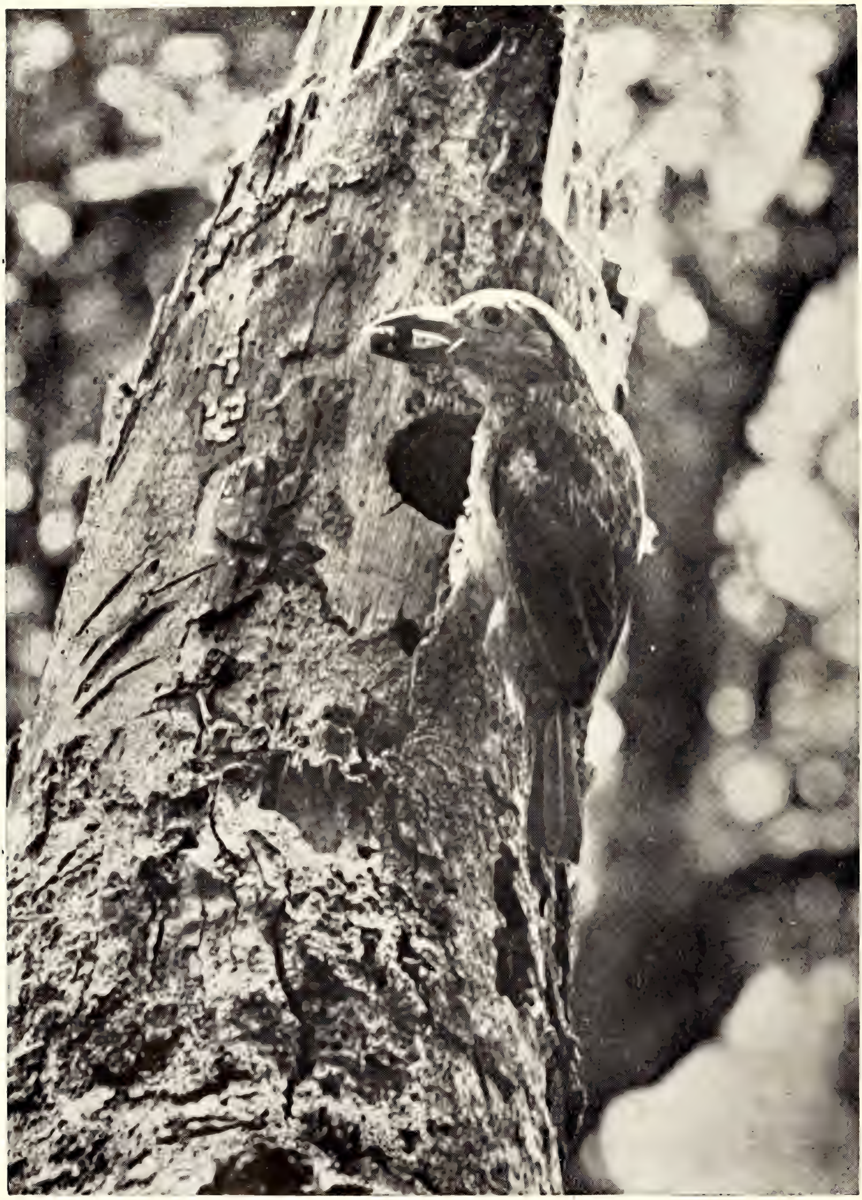
The nests or rather nest holes of the common little Indian Bee-eaters are to be met with all over the plateau, in the sides of ditches, borrow-pits, ruts by the sides of the roads, and even in the level open glades, a mere raised clod of earth or slight hollow sufficing to give a start to the often slightly downward trending tunnel. They were nesting at any rate up to the beginning of the rains, that is up to the end of June, and I found them at it when I arrived in April, so their season is a fairly long one.

I had a peculiar experience with a nest of this species. I was seated at the edge of a slightly convex glade and kept noticing a bee-eater descending to the ground and disappearing from view just beyond the crest. On going to investigate, I found a hole in the side of a slight depression. In front of the hole and extending back from it for about two feet was strewn a considerable amount of freshly ejected sand. Amongst the sand were scattered three eggs, one of them almost buried. They were not even close together but lying about six inches apart. The only reason I can adduce for this peculiar state of affairs is that the bird for some reason or other, and probably a very good one too, was lengthening its nest-hole and had carried out the eggs whilst so employed.

The Small Minivet is a very common little bird and is usually to be seen in small flocks flying from tree-summit to tree-summit, though occasionally they come nearer to the ground to search for food in the lower bushes. As a rule the tiny camouflaged nest is placed high up across a branch or on a horizontal fork. I say as a rule, as of the five nests which I managed to spot, three were high up in peepul trees, one about twenty feet up on an outer branch of a mohwa, and the fifth not more than nine feet from the ground near the leafy extremity of a branch of a quite small tree at the edge of the classification range. The branch had a number of thickenings in it, which made the nest almost impossible to spot. In fact I would never have realized that it was there had not the



THE INDIAN PURPLE SUNBIRD
(*Leptocoma asiatica asiatica*)



THE NORTHERN GREEN BARBET
(*Thereiceryx zeylanicus caniceps*)

head and tail of the sitting female been easily visible sticking out on either side of the bough. This nest was discovered on May 5th. I rather think the nidification of these birds was over by the end of that month.

The other very common birds of the plateau are Indian House and Jungle Crows, Smaller White Scavenger Vultures, which are exceptionally tame and wander round about the bungalows as if they owned them, White-bellied Drongos, Southern Jungle Babblers, Hawk-Cuckoos, Grey Hornbills, Northern Green Barbets, Thick-billed Flower-peckers, and Large Indian Cuckoo-shrikes, the latter noisy blue-grey birds almost the size of a pigeon, with a rather massive black bill and black face and a rather heavy flight. They stick to the tops of the trees and seldom come near the ground. They also possess somewhat loud screaming calls.

Indian Rollers, Indian White-breasted Kingfishers, Northern Golden-backed Woodpeckers, Northern Indian Stone-chats, Central Indian Red-vented Bulbuls, Tailor-birds and Indian Magpie Robins are also pretty common, as are Indian Hoopoes, Crimson-breasted Barbets, and three kinds of Paroquets, namely the Western Blossom-headed and Rose-ringed Paroquets, and the Large Indian Paroquet, the last-named appearing to me by far the commonest of the three. Towards the end of our stay, i.e. in August, large numbers of the two latter invaded the station in search of the food afforded by the ripening of the fruit on certain of the large trees. The Brown-backed Indian Robin appeared to me to be rather scarce. There was one nest near the R. C. Church which was robbed of its young ones on May 20th, and one pair was always to be seen in the gardens. Only once did I see one elsewhere. The only really common dove is the Indian Spotted Dove, though the Indian Turtle Dove is also to be met with in the forests around. Indian Pipits are common in the open spaces and along the Waingunga right down to the lake and breed certainly up to the commencement of the rains.

I see I have mentioned neither Swallows nor Tits. Around the bridge and the Government Gardens numbers of Syke's Striated Swallows, and Dusky Crag-Martins are always to be seen. Where they breed I do not know, but there are of course hundreds of suitable sites in the rocks and cliffs around the plateau's edge. There are two kinds of tits, one of which, the Indian Grey Tit, is fairly scarce. The other is the Southern Yellow-cheeked Tit which is exceedingly numerous, and, with its large and rather untidy black crest and somewhat speckly plumage together with its oft repeated and distinctive notes, is sure to be very soon added to one's list of birds seen in Pachmarhi.

One Grey Tit's nest with young ones in it was all I found, as owing to the course I had not the time to hunt for them when the majority would be breeding, i.e. in April and May. The nest in question was in a hole in a very small sapling on the path to Jumboo Dip, just opposite the point where the small stream one strikes near the top turns through some boulders and falls into the main valley. The sapling was only about four inches thick and the entrance hole was so small that I would never have thought of its holding a nest, had not I seen one of the birds go in. Before popping out the little thing put its head out of the hole for a look round, and the minuteness of the hole can be gauged by the fact that the bird's head appeared to fill it completely. The date of this discovery, by the way, was July 13th. Both these tits incidentally are birds both of the plateau and the ravines, possibly belonging more to the latter division.

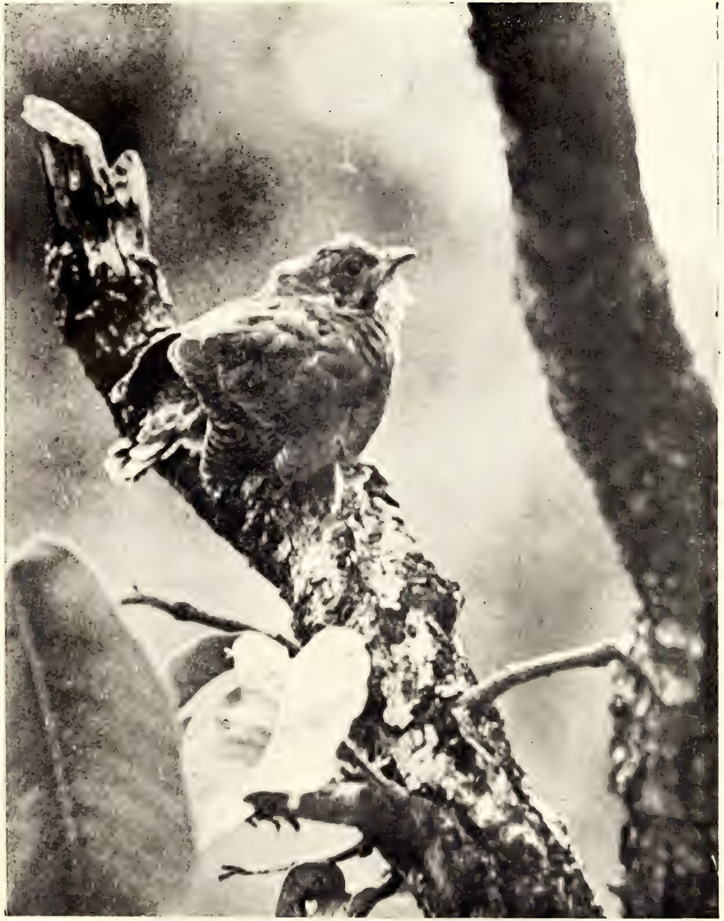
Another bird of the ravine zone, of all three zones as a matter of fact, which is by no means uncommon in the woods on the plateau is Tickell's Blue Fly-catcher. This rather squat little fly-catcher, which is dark blue above, ferruginous and white below, possesses a metallic unmistakeable short song of about half a dozen notes, the first half descending, the second half ascending, the scale, and to which it frequently gives vent. As I have said, it is found wherever there are trees, but perhaps its chief stronghold on the plateau is the Hogsback, where it is very common at the edges in the little nullahs which abound in that feature. This bird was breeding very freely in July, but I will describe my experiences with it when I get on to the ravine birds.

The Hogsback is a happy hunting ground, so I paid it a fair number of visits, and two birds, besides most of those which I have already mentioned, were nearly always to be seen along the summit of the ridge; one, the Common Wood-shrike; the other, Jerdon's Chloropsis. This Chloropsis is probably much more common than one would suspect, but they remain amongst the thick upper foliage of the trees with which their bright green plumage blends only too well. They are most excellent mimics however and this habit often gives them away. I stood below a tree on the Hogsback one morning listening to a pair practising. In subdued tones they were taking off a number of birds to perfection, especially the tree-pie, and really the only noticeable difference from the original was in the smaller volume of sound.

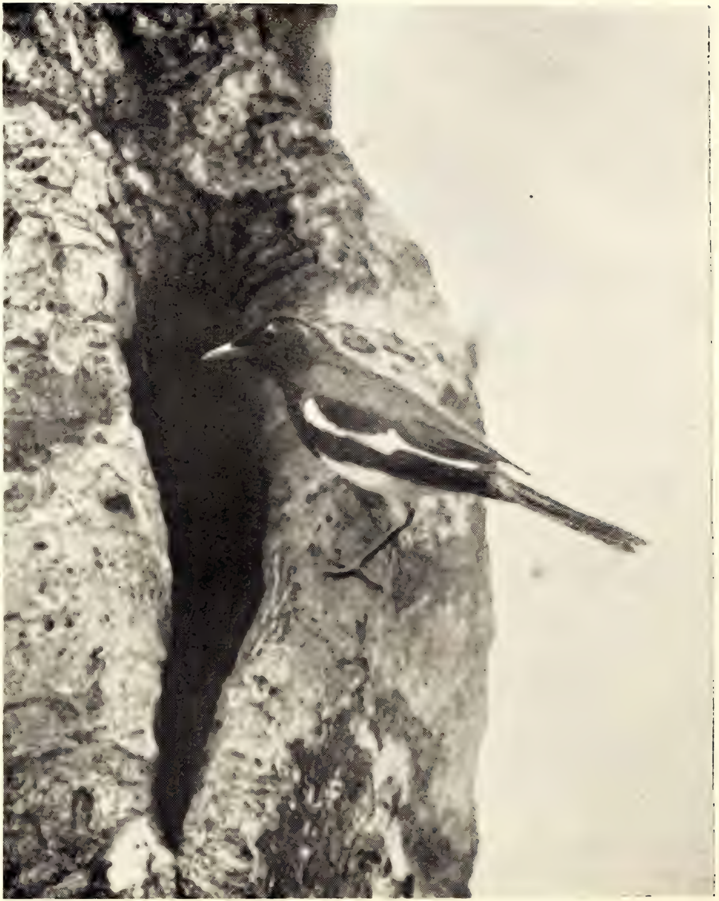
Southern Jungle Babblers were of course common on the Hogsback and I found three nests there, one containing four eggs including a Hawk-cuckoo's. In Pachmarhi the Common Hawk-cuckoo is a very common bird and its wild screaming crescendo call is to be heard almost any time during day or night. It is parasitic chiefly on the Jungle Babbler. The babbler's nest in question was in an outer fork of a small forest tree on the summit of the ridge. I discovered it on July 14. The cuckoo's egg was not difficult to distinguish from the others, as it was slightly larger, almost oval and of a slightly deeper shade of blue; in fact what I should call a deep turquoise blue. It was also not quite so glossy. The eggs were evidently quite fresh then as I visited the nest on two subsequent occasions during the next ten days and found it still in the same condition. On July 30th however the babbler was sitting over a young cuckoo, hatched some three or four days by the look of it. Of the bird's own eggs of young there was no sign whatsoever, not even on the ground beneath the nest. I searched the grass thoroughly but could not find even the trace of a broken egg or the remains of a newly hatched chick, so how the young murderer had disposed of its unwanted foster-brethren, I do not know. Of course

THE COMMON INDIAN HOUSE-CROW
(*Corvus splendens splendens*)

THE SMALLER WHITE SCAVENGER VULTURE
(*Neophron percnopterus ginginianus*)



THE COMMON HAWK-CUCKOO
(*Hierococcyx varius*)



THE INDIAN MAGPIE ROBIN
(*Copsychus saularis saularis*)

there are plenty of vermin and ants, etc., always moving about these places, and all traces of the tragedy would soon be wiped out. On August 1st, although the cuckoo's body must have been about the same size as that of its forest parent it was still decidedly naked, though the feathers showed signs of sprouting, especially in a peculiar manner down the back. Even when I took the photos on August 5th, the centre of its back under the folded wings was still naked. I had no opportunity of seeing how long it actually remained in the nest—I put it back again after taking the photographs—as I left for Saugor two days later.

I only used the hiding tent on two occasions on the plateau, in order to obtain photos of the Northern Green Barbet and Indian Magpie Robin. The Green Barbet's nesting season seems to be rather a long one. They were going strong when we first went up, and even after I took the photographs of this bird I noticed others still occupied with young ones. The nest which produced the illustration here was found on July 3rd. I think the female was sitting but whether on eggs or young, I don't know. The hole was in a decayed tree trunk about fifteen feet high. Fortunately it was only about a quarter of a mile, if that, from the house, so to get the camera nearer to the level of the nest, I had a table carried out and on this I rigged up the tent. Not knowing the temperament of the birds I was to deal with, I took no risks—although the tree trunk was quite close to some servants' quarters—and camouflaged the whole thing pretty thoroughly. The table of course did not get one anything like up to the same level as the nest and the lens had still to be tilted up to a most fearsome-looking angle somewhere in the neighbourhood of 45°. Even so, I do not think the photos have suffered to any appreciable extent thereby. I remained in the hide for an hour and a half during which time the bird came on eight occasions, to begin with at intervals of about eight minutes or so, but later, I think owing to doubt as to the nature of the noise of the shutter, the time just about doubled itself. On each occasion figs, usually two, were brought from a peepul tree hard by. There were light clouds about which were just sufficient to destroy the deep shadows, but not to do away with the impression of sunlight, so I used exposures of $\frac{1}{50}$ sec. at *f*. 5·4, $\frac{1}{30}$ at *f*. 8, and $\frac{1}{25}$ sec. at *f*. 11. All five plates turned out very well indeed, *f*. 8 and $\frac{1}{30}$ sec. producing the best results. I was a bit late in pressing the release on one occasion, resulting in blurred wings as the bird spread them to take to flight.

The Magpie Robin's nest was near the base of a smallish tree quite close to the porch of another bungalow and consequently the photography of the bird ought not to have presented any difficulties as it was far from shy. As there were large young ones in the nest I was not able to wait for a break in the rains however, and in consequence the day I chose for operations was not quite as good as it might have been. One moment the sun would be shining, the next a pretty thick mist would be swirling by and occasionally a light drizzle fell. I have always found it most difficult to judge the condition of the light on such occasions, and consequently the negatives I got this time were not up to standard. This matter of judging the light presents a greater difficulty than one would imagine. I remember on one occasion getting into the hide to try my luck with an Ashy Wren-Warbler. The day was certainly dull to start with, but when I left the hide I was amazed to find myself in a thick fog and a light so feeble that I knew, before I developed the plates, that they would be hopelessly under exposed, and so of course they were. For the Magpie Robin I used exposures of $\frac{1}{30}$ and $\frac{1}{25}$ at *f.* 5·4. and $\frac{1}{15}$ sec. at *f.* 11, but all the negatives show signs of under exposure.

I think I have now finished with the commoner birds of the plateau. Perhaps it might be of use to others to know that I missed an excellent opportunity of obtaining photographs of White-breasted Kingfishers through looking for their nests too late. In the bank of the nullah which runs between the Hogsback and Government House, on July 8th, I found a nesting hole, which judging by its damp condition and somewhat offensive odour, had only been vacated a very short time indeed. In fact the whole family was kicking up the most infernal noise in the trees close by. I was distinctly annoyed about this, as eight days previously I had been following this nullah down from its source and had turned off not fifty yards above this nest in order to watch the antics of a Tickell's Blue Flycatcher. After this I hunted about in other places on the plateau in the hopes of finding a nest with young still in it, but I was unable to do so.

Besides the Northern Golden-backed Woodpecker there is one other bird of this family one is more than likely to fall in with, and this is the Yellow-fronted Pied Woodpecker. It is a small speckled bird not much bigger than a Copper-smith. Its nesting hole is also about the size of that bird's.

As regards birds of prey two are pretty common—leaving out kites and scavenger vultures of course—these being the Shikra and the White-eyed Buzzard-Eagle. The Buzzard-Eagle is a small hawk-like bird not so very much larger than a pigeon. Its colouration is rather patchy, the legs fairly long and yellow, but its chief characteristic is its habit of sitting on the ground, when it will often allow one to approach quite close before flying up into the nearest tree, or, if well in the open, flying off to alight again probably but a hundred yards or so away. Vultures also visit the plateau and of owls two are commonly heard, the second one being also visible by day on occasions, i.e. the Collared Scops Owl and the Jungle Owlet.

Wherever one goes one always finds a favourite and favoured spot where birds of many kinds may always be found and where, if one sits down quietly in a sheltered spot and merely looks around, one is always sure of observing something of interest. One such spot I discovered just above Bee-dam. The stream forks about a hundred yards or so above the pool, the main branch flowing from under the circle of high cliffs another couple of hundred yards higher up, which marks the exit of the strange underground portion of the stream ; the other branch, which is almost waterless, coming from a small side nullah running up to the eastern end of Langee Hill. From the junction the stream should tumble over a small fall, but the water has eaten its way into the soft sandstone and now goes through the centre of the rocks. There are here some very large trees and a considerable amount of overhanging cover, rendering the junction and the small horseshoe-shaped fall somewhat sombre though peaceful. It was here on a stone—not more than 15 yards from the short cut to the bathing pool incidentally—that I sat on a number of occasions and from where I watched many species typical of the ravine avifauna.

On my first visit I noticed a beautiful little nest of the Northern Indian Black-naped Fly-catcher stuck by its side to a single vertical strand of creeper hanging directly over the stream. It was a lovely little affair, not unlike that of the Fantail Fly-catcher in shape and mode of attachment but made chiefly of green moss instead of grass. It was empty when I found it and never contained eggs to my knowledge, though it had probably been robbed before I ever spotted it on July 8th. There was a pair of birds at the dam itself which I think had made this nest and had moved down stream a bit to try again. They were successful too, as on the 28th after an hour's search I found a young one which had obviously but recently left the nest. I never found this second nest incidentally though I had searched for it on three previous occasions. The parents were noisy and fussy, mobbing every crow which appeared anywhere near the place. Nevertheless they were very wary and careful not to give away the actual position of their home.

Three other fly-catchers were seen from my vantage point and all on this same day, namely the Grey-headed, the White-spotted Fantail, and Tickell's Blue Fly-catchers. On July 28th, a pair of the first-named were engaged in feeding two young ones, which had also been hatched out in the vicinity of the dam, the nest I think being fairly high up against the high cliff between the pool and the dhobi ghat. These energetic little birds have a few pleasant and somewhat loud call notes.

The nest of the Grey-headed Fly-catcher is by no means easy to find. It is a small structure of green moss often forming only half a circle placed against the side of a moss-covered trunk or rock, and is consequently almost indistinguishable from its surroundings. The only one I succeeded in finding, was a very lately vacated one on the path up Dhupgarh. I had actually looked over the very rock on a small ledge of which it was placed amongst some living moss which it watched perfectly. Every time I had gone up or down the path my topi must have almost touched it. On the occasion on which I did inspect this rock it had just been raining and everything was dripping wet, so perhaps I did not examine it quite as closely as I might have done. The birds themselves drew my attention to the locality by the way they fussed round about a tree on the opposite side of the path to this projecting boulder. It must then have contained young ones, as it was only a couple of days later that I found it empty while I was looking for a Tickell's Blue Fly-catcher's nest which turned out to be in a somewhat similar situation some 15 yards further up.

The Fantails, also a pair, did not, I think, possess a nest but were merely hunting about for food in their usual jerky energetic manner.

Of course as I had not got a camera with me one of them pirouetted about a bit of creeper not 4 feet from my head evidently quite unafraid of me. They are not uncommon in all the ravines and a pair had a nest on the path down to Waters' Meet which contained two eggs on July 16th. These eggs unfortunately were never hatched as the nest was empty a couple of days later.

The third pair of fly-catchers—Tickell's Blue Fly-catchers, was building on a small ledge protected by the foliage overhanging the left side of the fall. I could not get at the nest however, and it was not in a good position for photography. A few days previously I had tried conclusions with a pair of these birds a little higher up the stream. Almost at the head of the nullah is a deep pit some 20 or 30 feet across, at the bottom of which the stream disappears down a fissure in the rock to appear again from under the high cliff I have already mentioned. About two-thirds down this pot hole under an overhanging lip of earth and grass was a nest containing three half grown young ones. Fortunately for me near by there was a projecting ledge about 2½ feet wide down to which it was quite easy to get the hiding tent, though to erect it and to camouflage the outside was attended by considerable difficulty as the tent was as wide as the ledge and only a foot shorter. This shelf was above the level of the nesting site, so the immediate entrance to the nest was out of view of the lens, but one long strand of creeper ran diagonally across it, so on this I focussed the camera, confidently expecting that the bird would occasionally alight on it on its way to its young ones. However I was had on toast in exactly the same way as I was previously by a Nilgiri Blue Fly-catcher. The bird, in this instance the male, on most occasions flew straight into the nest and so disappeared completely from view each time it came. I therefore stuffed up the entrance with leaves and ferns and tried again. The bird must have come to the nest at least a dozen times, but only twice did it land on the creeper, the other times it hovered outside close to the obstruction like an enormous but unsteady bumble bee.

One of the two negatives is quite good but I am sorry to say quite useless, as it gives one an altogether erroneous impression of the bird's colouration. I was using Ilford Iso-Zenith plates on account of the darkness of the pot-hole. There was no sun, as it was blotted out by a light mist, so I could not have used either slower plates or light filters. The general colour of the upper parts of the male is a pretty dark blue, though from the tent it appeared almost black. Nevertheless the blue has affected the plates to such an extent that from the prints one would judge the bird to be dirty white.

On July 19th I found another nest, with three eggs in it. As it was in an ideal situation, being not more than two feet from the ground on a ledge of rock close to the bank of the other fork of the Bee stream and in a well-lighted spot, I decided to make another attempt using Ilford Auto-filter plates, but for some unaccountable reason the bird deserted the very next day. I do not think the fault was mine, as I never touched the nest and in fact did not even stop in front of it. Also on going away I saw both birds fly to the rock. I rather think the female must have been killed, as

I twice went to look at the site and saw the male alone on both occasions. Including old ones, I found about a dozen nests of this bird, only one of which was against a tree trunk, the remainder being in somewhat similar situations on ledges of rocks.

From my vantage point I also saw the following birds :— White-Eyes, Yellow-cheeked Tits, Green Barbets, and White-bellied Drongos, all of which are common everywhere with the exception perhaps of on the higher hill tops. On each occasion a pair of Black-crested Yellow Bulbuls and a pair of Malabar Whistling Thrushes came, and of course numbers of Tree-pies and Thick-billed Flower-peckers. I also once saw a Southern Red-Whiskered Bulbul. The Red-Whiskered Bulbul's stronghold is however Dhupgarh and they appear to be rare elsewhere. The Black-crested Yellow-Bulbul is also a somewhat rare bird which occurs only in the ravines. This handsome bulbul gives one the impression of being more a vivid green bird with a black top knot rather than being mostly yellow.

The Malabar Whistling Thrush is quite the most striking bird of the ravine avifauna. It does, it is true, frequently stray on to the plateau, but it is essentially a ravine bird haunting all the perennial streams. At the beginning of May its vocal powers develop and its meandering, painfully human whistling is certain to attract one's attention. On the first occasion that we visited Pathar-Chatta, just as we were dropping into the deep gorge near the bottom, a loud whistling suddenly broke out. I stopped dead, and in an aggrieved tone said to my wife ' some one is down before us ' so human were the first few notes. Of course it was only our friend the whistling school-boy ; the first one I had heard in Pachmarhi in full blast. In these hills the rocks and cliffs are seamed with crevices and drilled with holes and inside these the thrushes place their nests. The result is that they are hard to spot, and consequently I could only mark down one—on the Jumboo Dip stream—and this was inaccessible. I hunted the stream, the Bee-stream I mean, and it appendages from the source to the bottom of its exceptionally pretty falls about a mile below the dam but could not find a nest, though I am perfectly certain that two pairs had nests somewhere along its course. These falls incidentally are not mentioned in the guide book, though to my mind they are more worthy of a visit than all the others.

I nearly got a photo of one of these fine birds when I was operating upon the Blue Fly-catcher, as one landed in the pit and started feeding on a ledge in front of, but a little above, the tent. I slowly raised the lens, but found I could not get it quite high enough without moving the front flap of the tent. This of course alarmed it and it flew off. I have since provided the camera with a sort of tilting-table operated by a screw, which I find most useful.

There are of course a goodly number of other birds to be found in these ravines including jungle and spur fowl and certain members of the birds of prey, both diurnal and otherwise, and there are three small birds which I certainly ought to mention. One is the Common Indian Kingfisher which is fairly often to be met with, especially on the main Denwa river at such places as Pansy Pool and the other bathing places, and after the rains have broken occasionally on the plateau as well. The other two are the Spotted Babbler and the Bombay Quaker Babbler. Both these birds are possessed of distinctive songs, the former of a most striking one consisting of a fairly loud and tuneful whistle. It is a shy skulking babbler spending most of its time in pretty thick cover, hunting about on the ground occasionally in small parties but usually alone or in pairs, and consequent on these habits it is more often heard than seen. The Quaker Babbler also prefers quiet woods but is usually found near streams. It is a nondescript brownish bird about the size of a robin and is also of rather solitary habits. It is fairly shy too but can be watched if one goes about it with care. Its song is not unlike that of Tickell's Blue Fly-catcher, consisting of about the same number of notes, but it is louder, slower, and not so metallic.

Handikho by the way, the most striking, impressive, and inaccessible of the Pachmarhi ravines, is a great stronghold of various species of vultures and of flocks of blue rock-pigeons. I think I have now mentioned the commoner ravine birds and can pass on to the birds of the third zone.

I am sorry to say I visited neither Mahadeo nor Chawragarh but in Dhupgarh I found a very productive hunting ground indeed which I visited whenever the thick mists and rain allowed me to, which unfortunately was not very often. Once the rains break, the hill is often invisible for days on end, the thick mist covering all but its base, and even when it does emerge, one is never certain for how long it will remain clear. It obviously receives a very much larger rainfall than the plateau and this of course affects its flora and fauna to no small degree. To digress, it also causes an increase of rain over the neighbouring end of the plateau, and, as one goes along the motor road towards it, from Keatinge Point onwards one cannot help noticing that the undergrowth becomes ranker, the grass longer and thicker and the ground more sodden-looking.

From the very moment one commences to ascend the path which winds upwards beneath the western precipitious face of the mount, one cannot help but realise the super-birdishness of the place. From all sides avian voices are borne in upon one's ears, those birds chiefly responsible being Red-whiskered Bulbuls, White bellied Drongos, Blue Fly-Catchers and Wren-warblers. Dhupgarh is the home of a fine Blackbird which is undoubtedly one of the best songsters in India. Its habitat is par excellence the oblong plateau about 200 feet below the hill's summit, but one or two are generally to be seen or heard along the lower reaches of the path. Malabar Whistling Thrushes are also generally in evidence, and their voices are not only wafted up from the ravines below but from the vicinity of the cliff face itself and even the chotta plateau.

About two-thirds of the way up the main trend of this path bends round to the right following the side of a nullah which terminates in the said plateau behind the main cliff.

The upper reaches of this nullah are a mass of thick jungle, largely bamboo, and on reaching this turning point new voices are at once remarked. There are always a number of babblers here, but I have only been able to identify two species definitely, namely the Spotted Babbler, by its voice of course, and Hume's Scimitar Babbler. Whenever I went specially armed with the ·410 to collect specimens of other members of the family, I either failed to see any, or, what is worse, failed to hit them. My luck was always dead out.

Hume's Scimitar Babbler is another bird with a highly distinctive voice. Its one and only area in the hills around Pachmarhi appears to be in the thick cover on the far side of this nullah I have been talking about. It is a brown bird about the size of, but slenderer than, a myna with a white vest and abdomen, a white eye-stripe, a long curved yellow beak and a voice which I can only describe as a bubbling one.

At the opposite end of the Pachmarhi plateau is a very narrow deep gorge full of undergrowth and heavy jungle an eerie place indeed in the fading light. Into this one has to descend to reach a certain cave, by name Jata Shankar. I only once visited this gloomy spot, and besides hearing a Panther in its depths I thought I heard the call—unfortunately it was not repeated—of a Scimitar Babbler. Had I been staying on I would certainly have gone again, and I hope others on reading this, will pay the place a visit.

However to hark back to Dhupgarh : one is now on the fringe of a considerable plateau in the centre of which there stands a well built inspection bungalow. This plateau, one might say, is the property of the Black-capped Blackbirds, Wren-warblers, and a number of Babblers. It consists of stretches of open ground and patches of jungle of varying heights and denseness. The open spaces are covered either with rough grass in tufts and low straggling bushes or with tall grass above one's head through which it is difficult to force one's way. Patches of bamboo also abound.

The Wren-warblers chiefly inhabiting the grass lands are the Indian Wren-warbler, Stewarts' Ashy Wren-warbler, and Franklin's Wren-warbler. All three are easy to identify, the first named being very plain, and the second of a fairly rich colouration, dark ashy above, and yellowish below. The third is also very soberly arrayed but has a fairly distinct greyish collar. It is also a noisy bird and more inclined to be found in the patches of jungle and in parties that the others are. These Wren-warblers also occur sparingly on the main plateau. I once heard an Ashy Wren-warbler near Government House and saw on two or three occasions Franklin's Wren-warblers in the thinner woods bordering the base of the Hogsback.

On July 23rd, I found a Stewart's Ashy Wren-warbler's nest in a patch of short grass about one hundred yards from the inspection bungalow. It was in a low large-leafed straggling bush and was a perfect example of the Tailor-bird type, consisting of two leaves stitched together containing a very scanty lining of grass and down. It contained three newly hatched young ones. The female flew off the nest otherwise I would not have noticed it. The weather had been kind for the last two days, therefore, as it looked as if the break would hold, we decided to bring up the tent and our lunch and spend the whole of the next day operating on this nest, and if time permitted looking for others as well.

The weather seemed fairly alright when we started but before we even reached the hill the mist was to be seen wreathing around its summit. Half way up we found ourselves in a thin drizzle, and on emerging on to the small plateau a chilling blast and heavy rain met us full in the face. By the time we reached the bungalow we were half-frozen and pretty well soaked, and to add to our discomfort the place was locked up. Luckily a window-pane was missing, so we were soon inside, but alas little better off as Dhupgarh in wet weather is the dreariest, windiest most uninviting spot I've ever struck, or so I felt then. Fortunately the kansamah suddenly appeared out of the fog, opened up the godowns where dry wood was to be found and soon had a goodly fire and some hot tea going, which raised our spirits a bit. We waited in the bungalow till after four o'clock when the fog lifted a little and the rain ceased. We then made a dash for home leaving the half plate camera and the tent in the bungalow in the hopes that the fine spell had not really broken. I was doomed to be disappointed however, as for three days it rained continuously. On the fourth day I tried again, but as before as I went up the mist came down, and I might just as well have saved myself the trouble for I found the nest in pieces on the ground. It looked rather flimsy when I found it, so I think the increasing weight of the young ones, and the soaking it had received, had been too much for it.

The one redeeming feature of these expeditions was that I got a nest of the Black-capped Blackbird. It was just behind the bungalow in a fairly large rather moss covered tree, and placed on an outer fork of a horizontal branch thereof, well screened by the leaves of another branch just above it. From below it looked like a pretty tidy bundle of living moss. It would be between 15 and 20 feet from the ground, and contained three eggs. In colouration they were blue with well distributed and well defined blotches of reddish and purplish brown. They are in fact indistinguishable from many eggs of the Nilgiri Blackbird I have seen but a bit smaller, the three eggs averaging 29·1 mm. by 20·2 mm. The female was a light sitter—I would not have found the nest otherwise—and she always left whenever one approached the tree.

While we were waiting in the bungalow, I heard a Blackbird's strains floating in from the direction of the tree. I thought the male bird must have appeared on the scene but on going to look found it was emanating from the sitting female. It was raining in bucket-fulls and a thick mist made it impossible to see anything more than 50 yards distant, so perhaps she was singing to keep warm or to keep up her spirits on such a depressing day.

I shall always regret that I did not spend a week end in the bungalow before the rains began, especially as they did not break for some days after the end of the course. Dhupgarh is an interesting place and to explore it thoroughly would take some days, and I am sure a protracted visit would result in considerable additions to the list of Pachmarhi's birds.

Before I close these notes I think a few remarks are indicated on those birds I saw which Mr. Osmaston has got down in his list as winter visitors. Dates on which migratory birds are seen in different districts are always of use.

On April 15th, I saw an Indian Blue Rock-Thrush on the roof of an empty bungalow near the Malcolm Point path. I again saw it two days later.

Up to April 16th, Indian Tree Pipits were not uncommon, but no more were seen after that date.

On April 16th, a single Eastern Grey Wagtail and a Common Sandpiper were also seen.

On July 27th, I saw a Bay-backed Shrike near the Government gardens. As regards the Rufous-backed Shrike, I think it might better be described as an occasional, rather than a winter, visitor. From the 11th up to the 25th April one haunted a date-palm at the bend in the river by the Towers, and on the 12th June another was seen in the Government Gardens. I saw one in between these dates too but I find I have not recorded it in my diary.

One other statement in the list needs enlarging upon, i.e., the fact that the Large Grey Babbler is said not to occur on the plateau proper. From July 14th till we left a party of six could always be found between the race-course and the Hogsback. Another smaller party also affected the open jungle just beyond the western end of the Hogsback.

It only remains now to give the names of those birds identified, which are not down on Mr. Osmaston's list at all. First and foremost comes the Black-capped Blackbird which I have already talked about.

On May 2nd, there appeared over the lake a flock of twelve Night Herons. They circled round once or twice but did not alight, continuing their journey over the plateau and disappearing in the direction of the southern end of Dhupgarh.

On the same day and also about a week later I saw an Indian Oriole, near Government House.

On July 7th, a bird, which I am as certain as one can be under the circumstances was an Indian Rufous-tailed Finch-Lark, flew from under my wife's feet on the road running close to the railings over looking Handikho.

On July 11th, a flock of 5, and on August 1st a flock of 4, Madras Black-headed Munias were seen in the gardens.

On July 14th, a Pied Crested Cuckoo was spotted near Foxrock, and on the 21st a Wood Sandpiper was disturbed feeding at a muddy little pool on the golf links. Surely this is a very early date for this bird's arrival in the C.P., though perhaps it had never trecked North at all.

Lastly a Green Munia was shot on Dhupgarh on July 29th. A pair flew out of a tuft of grass close to a clump of bamboo on the Chota plateau. I hunted through the clump in the hopes that there might be a nest, but could find no signs of one. I had never struck this beautiful little bird before. Its bright colours are most striking and I had no idea any Munia could be so exquisitely dressed. The main characteristics, which strike one in the living bird, are the velvety black tail, the feathers of which are rounded, and not pointed, the brown and white striped flanks, and the colourful bright green back and yellow underparts.

ON A COLLECTION OF MOTHS OF THE FAMILY *GEOMETRIDÆ* FROM UPPER BURMA MADE BY CAPTAIN A. E. SWANN

BY

LOUIS B. PROUT, F.E.S.

PART IV

(*Continued from page 799 of this Volume.*)

* 243. *Ectropis marmorata* (Moore).

Arichanna marmorata Moore, *Proc. Zool. Soc. Lond.*, p. 659, Pl. xxiii, Fig. 3 (1867) (Bengal).

Hpimaw Fort, June 1923, 1 ♂.

* 244. *Ectropis enormis* (Warr.).

Myrioblephara enormis Warr., *Proc. Zool. Soc. Lond.*, p. 429 (1893) (Nagas).

Htawgaw, March 1923, 1 ♂, April 4–10, 1923, 1 ♀, June 1923, 1 ♂, August 1923, 1 ♀ ; Hpimaw Fort, June 1923, 21 ♂♂, early July 1923, 1 ♂, August 14–18, 1923, 1 ♂, 1 ♀.

A fine and somewhat variable series of this hitherto little-known species. The August specimens are rather small and aberrant-looking. In addition to the series registered above, I call particular attention to the following specimen :—

ab. Illota, ab. nov (? bon. sp.) ♂, 27 mm. *Forewing* heavily and almost uniformly irrorated with blackish fuscous, so that the markings, excepting the deeper black cell-mark and traces of the pale band beyond the postmedian, are almost obsolete ; costal margin, sub-basal band, anterior half of the double postmedian and some terminal cloudings also, on close attention, discernible by reason of a thickening of the dark irrotation. *Hindwing* more heavily suffused than on typical *enormis*, the cell-dot and postmedian line faint.

Underside of forewing more suffused, of hindwing more irrorated, than in typical *enormis*, but with cell-dots and postmedian lines fairly clear.

Hpimaw Fort, June 1923, 1 ♂.

By the structure, the coloration of abdomen, etc., I have scarcely any doubt that this is a remarkable aberration of *enormis*, but as, in addition to its small size, it has the forewing slightly narrower, the hindwing slightly less regularly rounded (a little more flat, or sinuate, from SC^2 to R^3, hence a little prominent about R^3–M^1) I think it desirable to name and describe it.

* 245. *Ectropis duplexa* (Moore).

Cleora duplexa, Moore, *Lep. Coll. Atk.*, p. 239 (1888) (Darjiling).

Htawgaw, March 1923, 1 ♂, April–May 1923, 1 ♂, June 1923, 3 ♂♂, early July 1923, 1 ♂, August 1923, 2 ♀♀ ; Hpimaw Fort, June 1923, 6 ♂♂, early July 1923, 1 ♀, August 9–13, 1923, 3 ♂♂, August 14–18, 1923, 1 ♀.

* 246. *Ectropis planaria* Swinh.

Ectropis planaria, Swinh., *Tr. Ent. Soc. Lond.*, p. 221 (1894) (Khasis).

Htawgaw, August 1923, 1 ♀.

A brightly coloured specimen. I have a similar ♀ from Darjiling. Conceivably a small form of *conifera*, Moore (*Lep. Coll. Atk.*, p. 239) ; in any case I cannot unite it with *ochrifasciata*, as is done by Hampson (*Faun. Ind.*, *Moths*, vol. iii, p. 259).

* 247. *Ectropis ochrifasciata* (Moore).

Cleora ochrifasciata Moore, *Lep. Coll. Atk.*, p. 240 (1888) (Darjiling).

Htawgaw, June 1923, 1 ♂, early July 1923, 4 ♂♂, 1 ♀, August 1923, 3 ♂♂ ; Hpare, August 1923, 1 ♀ (large form) ; Hpimaw Fort, June 1923, 1 ♂, August 14–18, 1923, 1 ♀ (large form).

* 248. *Ectropis æthregenes*, sp. n. (Pl. ii, Fig. 18).

♂, 25 mm. Head white, suffused with light brown. Palpus 1½, on outer side light brownish, with a few darker scales. Antennal fascicles of cilia very slender, long (3 or 4). Thorax and abdomen dirty white, above rather strongly blotched with light brown ; anal segments rather elongate.

Forewing with $SC^{1\cdot 2}$ coincident free ; fovea strong ; subtranslucent white, as in *marmorata*, Moore ; some sparse black irroration and light tawny-brown cloudings (much as in *marmorata*), which occupy most of the proximal area except fovea, an ill-defined band beyond the postmedian and parts of the terminal area ; a black cell-dot, with traces of a brown median line bent just outside it, then running inward very obliquely to M just proximal to base of M^2 ; postmedian outbent at R^1–R^2, but not very strongly ; subterminal lunulate dentate, interrupted ; terminal dots strong. *Hindwing* with termen slightly less strongly crenulate than in *marmorata* ; coloration, similar ; markings more as in *ochrifasciata* Moore, the median line being strongly oblique, the postmedian close beyond the cell-dot ; subterminal grey shades rather weak ; terminal dots strong.

Underside feebly marked, except for the postmedian line, chiefly on hindwing ; distinguishable at a glance from that of *marmorata* by the much more proximal position of this line.

Hpimaw Fort, early July 1923, the type only.

Much smaller than *marmorata*, the only similarly coloured species of the group ; more delicately built and with various differences in the markings.

* 249. *Ectropis defervescens*, sp. n.

♂, 26 mm. Near *ochrifasciata* Moore. Antennal ciliation rather longer (more '*Myrioblephara*'-like). Abdomen on 1st and 2nd tergites with paired black spots, on 3rd-6th almost wholly infuscated. Colouring less warm than in *ochrifasciata*.

Forewing with cell-dot rather elongate, oblique ; antemedian line excurved in cell, the shade proximal to it almost wholly blackish-fuscous ; postmedian less excurved behind R^1 than in *ochrifasciata*, not excurved behind M^2, throughout more broken into coarse vein-spots ; dark terminal blotch restricted to a dash on R^2 and a slighter one on R^1.

Hindwing whiter ; postmedian line and its distal shade almost equal in strength and in the degree of their denticulations.

Underside paler than in *ochrifasciata*, less fleshy-tinged ; postmedian of both wings less bent.

Htawgaw, April–May 1923, 3 ♂♂.

250. *Ectropis irrorata* (Moore).

Cleora irrorata Moore, *Lep. Coll. Atk.*, p. 240 (1888) (Darjiling).

Hpimaw Fort, early July 1923, 1 ♂.

251. *Ectropis simplaria* (Swinh).

Ectropis simplaria Swinh., *Tr. Ent. Soc. Lond.*, p. 221 (1894) (Khasis).

Htawgaw, July 1923, 3 ♂♂ ; Hpimaw Fort, July 1923, 1 ♀.

This species has representatives, if not races, throughout a great part of the Indo-Australian Region (compare *E. boarmiodes* Rothsch., *Nov. Zool.*, vol. xxii, p. 236, Ceram). At any rate it occurs with scarcely any appreciable modification in the Malay Peninsula and adjacent islands.

* 252. *Ectropis leucozona* (Hmpsn.).

Boarmia leucozona Hmpsn., *Faun. Ind. Moths*, vol. iii. p. 260 (1895) (Nagas).

Htawgaw, March 1923, 1 ♂ ; Blackrock, June 1923, 1 ♂ ; Hpimaw Fort, August 1923, 1 ♀ ; Hparê, August 1923, 1 ♀.

With the exception of the short series on which this species was founded and one or two specimens from the Khasis (where it must be quite rare), I know of no captures prior to Capt. Swann's. It is therefore interesting that he lighted upon it in so many spots, though always singly.

* 253. *Ectropis lophomeris*, sp. n. (Pl. ii, Fig. 21).

♂ ♀, 28–33 mm. Face pale brown. Palpus rather short, terminal joint minute ; somewhat dark-mixed on outer side. Vertex whitish or very pale brown. Antennal ciliation in ♂ a little over 1. Body whitish brown, the wingtegulæ and especially the collar tippets browner. Pectus and coxæ in ♂ roughly hairy. Fore and midleg largely darkened, irregularly pale-banded. Hind-femur in ♂ with tuft of long hair; hindtibia of ♂ with groove on innerside. Abdominal spine wanting.

Forewing with termen almost smooth; fovea wanting; SC^{12} in both sexes shortly stalked, SC^1 almost always anastomosing shortly or moderately with C, in one ♀ free; white, with irregular dark irroration and in places with red-brown shading; antemedian line grey or blackish, rarely very distinct throughout, at costa often blackened; usually a browner, less definite line or shade proximally to the antemedian; cell-dot black; median line nearly always redder, often arising from a blackish spot on costa, excurved or usually angulated about R^2; postmedian somewhat crenulate, with blacker vein-dots or minute teeth on a browner foundation; faint suggestions of a duplicating line beyond; subterminal markedly dentate, somewhat receding from termen between the outward tooth of cellule 4 and the inward one of R^3; irregular proximal shading to the subterminal, nearly always blackest between the radials, sometimes also at costa; apical region sometimes suffused with red-brown or with dark grey; termen with more or less elongate interneural dots or spots; fringe rather pale, with weak indications of dark bisecting line and often dark spots opposite the veins. *Hindwing* with termen waved or weakly subcrenulate; nearly concolorous, but less suffused with red-brown; cell-dot sharply black; lines continued, the median straightish, rather weak; postmedian slightly incurved at both folds; dark shades of subterminal more uniform than on forewing, rarely very strong.

Underside more yellowish; forewing with minute costal dots, slightly larger ones at position of antemedian and median lines, small black cell-dot and black-brown distal border of about 3 mm. width, sometimes nearly complete, sometimes fading out gradually behind middle, always more or less mixed with the ground-colour terminally at apex and about R^3; hindwing with large black cell-dot, weaker terminal marks and often some indications of dark border, especially anteriorly and at its proximal edge.

Htawgaw, April–May 1923, type ♂ and 1 ♀, July 1923, 1 ♂, 8 ♀♀, August 1923, 1 ♂, 1 ♀; Hpimaw Fort, 14–18, 1923, 1 ♀.

The later-brood specimens are nearly all smaller than the early pair. The type ♂ is more suffused with red-brown than most of the series, but its companion ♀ is by no means so.

* 254. *Ectropis zotica*, sp. n. (Pl. ii, Fig. 20).

♂, 30 mm. In shape, general coloration and pose of markings suggesting a very vividly coloured aberration of the preceding, but on closer examination abunduntly distinct. Head rather browner. Antennal ciliation longer (just over 2). Abdomen spotted or broadly belted dorsally with blackish fuscous. Abdominal spine developed (hindlegs lost).

Forewing with fovea; SC^1 running into C; brown shade outside median bright and strong reaching beyond postmedian; antemedian stronger, more proximal anteriorly, excurved about fold; median shade much thickened, blackish, absorbing the cell-dot; postmedian gently incurved between R^3 and M^2. *Hindwing* with a corresponding blackish median shade; duplicating line of postmedian light and bright; distal area a good deal suffused with brown; proximal tooth of subterminal on M^2 rather elongate.

Underside, in addition to the costal and terminal markings of *lophomeris*, with the lines and median shade of upperside largely reproduced; cell-spots large.

Htawgaw, July 1923, the type only.

* 255. *Ectropis albibasis* (Hmpsn.).

Boarmia albibasis Hmpsn., *Faun. Ind., Moths*. vol. iii, p. 278 (1895) (Sikkim).

Htawgaw, August 1923, 1 ♀.

A rather broad-bordered form, the median shade also rather broad.

Hampson founded this species on a ♀ and assumed the ♂ antenna to be pectinate, which is not the case; it has long ciliation; ♂ hindtibia with hair-pencil. A further and less excusable error concerns the venation; vein 10 is not stalked with 7, 8, 9 but arises from the cell, anastomosing slightly with C or remaining free.

Previously known only from Sikkim and Assam.

*256. *Ectropis hiulca*, sp. n. (Pl. ii, Fig. 17).

♀, 31 mm. Face dark fuscous (partly abraded). Palpus rather short, 2nd joint moderately stout, 3rd joint very small, blunt. Antenna minutely ciliated. Head and body whitish, irrorated with black, in places suffused with ochreous; some irregular maculation at base of abdomen above. Foreleg darkened on upper and innerside, the tibial and tarsal joints with pale terminal spots; other legs only feebly dark-mottled.

Forewing rather broad and *Gnophos*-like; SC$^{1\cdot2}$ co-incident, free; white, irrorated with black and clouded with ochreous; cell-dot strong, black; antemedian line outbent in cell, posteriorly fairly strong; median thickened from costa almost to R^2, then curving, posteriorly less black-mixed; postmedian very gently curved, formed of spots on the veins; subterminal line forming a strong inward curve from just before R^3 to just behind M^1, a blunt angle outward in cellule 2, a weaker inward curve behind; broad dark cloudings proximally to the subterminal; dark terminal shading strongest between costa and R^3; terminal line slightly waved; fringe weakly mottled. *Hindwing* with termen weakly and irregularly subcrenulate; costal margin pale and almost unmarked, the rest concolorous with forewing; cell-dot large; median shade straight, rather weak; postmedian scarcely beyond middle of wing, faint anteriorly, punctiform posteriorly; subterminal analogous to that of forewing, the costal cloud thinner and weaker.

Underside duller, the forewing slightly suffused, the markings (except cell-spots) weaker, but similarly formed.

Hpimaw Fort, August 14-18 1923, (type), June 1923, 1 ♀ (worn).

Affinities uncertain. The characteristic subterminal line is approached by that of *albibasis* Hmpsn. (especially the Htawgaw ab.), which also has a short forewing and a few other point of contact with it. The ♂ must be awaited for further structural clues.

* 257. *Ectropis embolochroma*, sp. n. (Plate ii, Fig. 8).

♂, 36 mm. Head brown. Palpus shortish, stout, terminal joint very small. Antennal shaft bright red-brown; ciliation extremely long and slender (genus *Myrioblephara* of Warren). Thorax brown, above mixed with blackish. Abdomen paler, the first segments dark-spotted above; anal tuft strong. Fore and midleg partly infuscated. Hindtibia not dilated.

Forewing rather elongate; fovea well developed; retinaculum rather broad; SC$^{1\cdot2}$ coincident, free; white, finely strigulated with red-brown; costa irregularly spotted; basal area red-brown; antemedian line strong, black-brown, preceded proximally by a broader, posteriorly tapering line or shade; cell-dot blackish; median shade only indicated by a red-brown costal spot; postmedian from little beyond midcosta, strong anteriorly, very gently curving to R^3, thence represented by vein-dots or small dashes; subterminal line interrupted by a white spot at R^3—M^1, shaded with black-brown proximally, especially in anterior half, between which and the postmedian stands a very characteristic red-brown patch; terminal area interruptedly shaded with red-brown and black-brown; interneural terminal black dots; fringe very feebly bisected moderately chequered. *Hindwing* with costa relatively rather short, termen crenulate in middle; white, the red-brown shading duller and less developed than on forewing, chiefly showing in a band just outside the postmedian; a blackish spot at base of M and SM^2 a slightly elongate black cell-mark; lines blackish on the veins, not reaching costa; postmedian close beyond cell, forming a long outward projection between R^3 and M^2 and again oblique outward between fold and SM^2; subterminal and terminal shades copious but vague; an ill-defined whitish terminal spot behind R^3.

Underside more glossy, more blurred, especially the forewing, which is predominantly somewhat smoky, only becoming whitish posteriorly, cell-marks well developed; forewing with the other markings vague, except a dark præ-subterminal shade and the white spot behind R^3; hindwing whiter, the lines better expressed, the median reaching costa, angled outward in cell.

Hpimaw Fort, August 1923, the type only.

The black-brown scaling is laid on in the 'fluted' manner well known in the genus *Glossotrophia*.

* 258. *Ectropis conspicuata* (Moore).

Menophra conspicuata Moore, *Lep. Coll. Atk.*, p. 237 (1888) (Darjiling).
Htawgaw, April–May 1923, 1 ♀.

* 259. *Ectropis bisinuata dignampta*, subsp. n.

♀ 31–32 mm. Less ochreous than *E b. bisinuata* Hmpsn. (*Faun. Ind. Moths*, vol. iii, p. 261, Nepal to Assam), darker, the irroration being predominantly blackish instead of brown. Median and postmedian lines of both wings slightly more distally placed. Underside distinctly less ochreous than in *b. bisinuata*.

Htawgaw, June 1923, 3 ♀♀.

Hampson's description is exceedingly bad, as the species has no connection with *scripturaria*. Moreover, as the ♂ hindtibia is dilated he ought to have referred the species to his section *Prorhinia*. Compare *Ent. Mitt.*, vol. iii, pp. 267–8, on *nigriflexa* Prout, which I now believe to be the Formosan race of *bisinuata*.

* 260. *Ectropis insecura*, sp. n.

♂, 31 mm. Structure nearly as in *bisinuata* Hmpsn., coloration and facies more recalling *inceptaria*, Walk. Palpus on outerside blacker than in *bisinuata*. Antennal ciliation rather long, about as in that species. Hindtibia dilated with hair-pencil.

Forewing with $SC^{1\cdot 2}$ anastomosing at a point with $SC^{3\ 4}$ (free in all the *bisinuata* I have examined); antemedian line less deeply curved than in *bisinuata*; median much as in *b. dignampta* the space between it and cell-spot conspicuously darkened; postmedian rather less strongly excurved anteriorly than in *bisinuata*, at hindmargin almost vertical instead of oblique outward.

Underside paler grey, *almost unmarked*.

Htawgaw, April–May 1923, the type only.

It is just possible that this may be a seasonal form of the insect which I have described as *bisinuata dignampta* (*supra*), notwithstanding the great disparity in the undersides; but it is too unlikely to be assumed without further evidence.

261. *Ectropis inceptaria* (Walk.).

Tephrosia inceptaria Walk., *List. Lep. Ins.*, vol. xxxv, p. 1590 (1866) (Flores).
Narapa breta. Swinh., *Proc. Zool. Soc Lond.*, p. (1889) (Nilgiris).
Laukhaung, July 1923, 1 ♂.

Common and widely distributed in India, the Malay Peninsula and the Sunda Islands.

262. *Ectropis indistincta* (Hmpsn.).

Cleora indistincta Hmpsn., *Ill. Hct.*, viii, 106, Pl. cl, Fig. 3 (1891) (Nilgiris).
Htawgaw, August 1923, 1 ♂.

Worn, but apparently—from its structure and small size—referable here. Hampson (*Faun. Ind., Moths*, vol. iii, p. 262) seems wrong in making this a 'form' of the preceding.

* 263. *Ectropis impos*, sp. n.

♂ ♀, 25–26 mm. Smaller and paler than *inceptaria* Walk, more like *indistincta*, Hmpsn. Distinguished from both by the absence of the tufts from hindcoxa and second abdominal sternite of the ♂, the larger black cell-dot of the hindwing, etc. Antennal ciliation of ♂ little over 1 (as in *inceptaria* or scarcely longer). Ground-colour white, the fine irroration grey, less brownish than in *inceptaria*; the shades of the subterminal, especially on forewing, rather strong, appearing to the naked eye more bluish black-grey than the rest; the subterminal itself much as in *lophomeris* Prout (*supra*), or with the inward tooth at M^2 still longer; postmedian line of forewing not quite so strongly incurved posteriorly as in *inceptaria*, thus less approximated to the median, the two here only blackened on SM^2 and without the dark shading between them which is generally characteristic of *inceptaria*; median of hindwing a little more curved, running to abdominal margin more obliquely.

Htawgaw, April–May 1923, 2 ♂♂, 1 ♀.

I at first took these specimens to be a form of *indistincta*, in which species—apart from the distinctions already noted—the antennal ciliation is appreciably longer, almost 2.

* 264. *Ectropis pulvicopia*, sp. n. (Pl. ii, Fig. 6).

♂, 32 mm. Face white-grey, a dark brown band across middle. Palpus blackish, the extreme end of the second joint and the small, pointed terminal joint white-grey. Vertex white-grey. Antennal ciliation slightly over 1. Thorax and abdomen concolorous with wings. Legs partly infuscated; hindtibia not dilated.

Forewing with termen smooth; fovea moderate; $SC^{1 \cdot 2}$ very shortly stalked, SC^1 anastomosing very strongly with C; white, very finely but copiously and evenly irrorated with grey; lines darker grey, slightly thickened at costal margin, the antemedian also at hindmargin; antemedian excurved in cell; median weak, strongly excurved outside the weak cell-dot; postmedian at about $\frac{5}{7}$, with small outward teeth on the veins, the lunules between mostly shallow; pale subterminal line also crenulate, but very indistinct, chiefly indicated by slight dark proximal shading; termen with weak interneural dots; fringe very slightly spotted opposite the veins.

Hindwing only weakly crenulate; antemedian line obsolete, otherwise similar to forewing.

Underside almost unmarked, forewing slightly smoky, hindwing slightly paler.

Htawgaw, early July 1923, the type only.

Near *serratilinea* Warr. (*Nov. Zool.*, vol. iii, p. 318), slightly smaller, rather colder grey, the crenulations of the postmedian less deep, the underside different.

* 265. *Ectropis dentilineata* (Moore).

Tephrosia dentilineata Moore, *Proc. Zool. Soc. Lond.* p. 631 (1867) (Darjiling).

Htawgaw, July 1923, 1 ♀.

Distributed in the Himalayas, where it represents *bistortata* Goeze of the Palæarctic Region (*crepuscularia* auctt., nec. Hb). Although the venational difference given by Hampson (*Faun. Ind.*, *Moths*, vol. iii, p. 260) has proved inconstant, it would be premature to merge the species. In the Htawgaw specimen the coincident vein ($SC^{1 \cdot 2}$) is just stalked and the ovipositor is extremely elongate.

266. *Ectropis*, sp.

Htawgaw, 1923, undated, 1 ♂.

A rather narrow-winged dusky species, apparently new, but much too worn to describe. Antinnal ciliation shortish, a long lateral pencil from base of abdomen, fovea very strong and $SC^{1 \cdot 2}$ of forewing shortly stalked are the principal structural characters and there seems to have been a conspicuous white mid-subterminal spot as in some of the *conspurcata* group, *intractabilis*, etc.

267. *Ectropis intractabilis* (Walk.) ab. ?

Homoptera intractabilis Walk. *Journ. Linn. Soc. Zool.*, vol. vii, p. 83 (1864) (Sarawak).

Hparê, September 1923, 1 ♀.

Rather broad-winged, hindwing perhaps rather too crenulate for this species, postmedian rather more curved. Not in very fresh condition.

E. intractabilis, under its synonym of *figlina* Swinh. (*Tr. Ent. Soc. Lond.*, 1890, p. 205) is well known from the Khasi and Karen Hills.

* 268. *Paradarisa chloauges*, sp. n.

♂, 45–48 mm. Close to *comparataria* Walk. (*List Lep. Ins.*, vol. xxxv, p. 1582). Abdomen with the hair of posterior sternites perhaps less dense. Wing slightly longer, of a more greenish tone, the irroration being olive-buff to olive. *Forewing* with similar venation; the liver-brown suffusion about hindmargin strong (noticeable in some *comparataria*, especially of the Formosan race (*rantaizanensis* Wileman, *The Entom* , vol. xlv, p. 258), antemedian line much less oblique inward posteriorly, its course not being changed at fold or SM^2; cell-mark more elongate; postmedian more deeply incurved at SC^5-R^1, much less incurved at fold, running to hindmargin vertically instead of markedly obliquely outward. *Hindwing* with cell-mark longer and stronger; median line rathar less divergent from postmedian anteriorly than in *comparataria*.

Underside much as in the more blurred examples of *comparataria*, the subterminal dark shades fairly broad but weak (in the paratype fairly strong anteriorly on forewing).

Hparē, September 1923 (type); Hpimaw Fort, August 14–18, 1923 (paratype).

P. rantaizanensis, which I regard as a race of *comparataria* (Wileman's type is a rather dusky aberration, most Formosan examples nearer the Indian), rather more approaches the tone of *chloauges* than does *C. comparataria*, but the course of its lines is quite as in the last-named.

* 269. *Paradarisa azyx*, sp. n.

♀, 43 mm. Apparently also close to *comparataria*, Walk., differing as follows:—

Wing slightly broader. General coloration rather more reddish than in the most highly coloured forms of *comparataria* and with the dark irroration stronger. Abdomen dorsally more darkened.

Forewing with the bifurcation of C and SC^1 more proximal (about opposite DC^2; in *comparataria* generally opposite origin of SC^5); antemedian line strongly excurved, in cell reaching 7 mm. from base; cell-mark larger but much weaker, suggesting an elongate ocellus; postmedian with the outward bend at R^2 much stronger, a slight additional outward bend at fold, the inward curve small and only between fold and SM^2, the final course to hindmargin oblique inward. *Hindwing* with median shade thicker and straighter than in *comparataria;* cell-mark as in forewing; postmedian more acutely inbent at fold.

Underside with the same distinctions in the cell-marks and lines; forewing with the outer dark band different, reaching virtually to termen (only faintly and narrowly pale-mixed at apex and midtermen), on the other hand separated from the postmedian between R^2 and costa by a subtriangular patch of the ground-colour.

Htawgaw, June 1923, the type only.

In the absence of the ♂ it is not quite certain that this will not prove a true *Medasina*, i.e. with the ♂ antenna pectinate.

* 270. *Diplurodes vestita* Warr.

Diplurodes vestita Warr., *Nov. Zool.*, vol. iii, p. 132 (1896) (Khasis).

Htawgaw, June 1923, 1 ♂, July 1923, 1 ♂.

These specimens agree accurately with the typical Khasi form, of which I have seen eight; whereas the other forms with which attempts have been made to unite it (Ceylon, Sarawak, etc.) are clearly distinguishable though closely allied. I believe most of the species of *Diplurodes* have only a restricted range.

271. *Cleora alienaria* (Walk.).

Boarmia alienaria Walk., *List Lep. Ins.*, vol. xxi, p. 370 (1860) (Sylhet).

Chogada fraterna, Moore, *Lep. Coll. Atk.*, p. 245 (1888) (Darjiling).

Htawgaw, June 1923, 1 ♂.

I believe this species, in different races, is distributed over a large part of the Indo-Australian Region, but a number of close allies have often been confused with it. A good figure of true *alienaria* is given by Hampson (*Faun. Ind. Moths*, vol. iii, p. 265, Fig. 137) under the erroneous name of *acaciaria*.

* 272. *Cleora variegata* (Moore).

Pseudocoremia variegata Moore, *Lep. Coll. Atk.*, p. 240 (1888) (Darjiling).

Htawgaw, June 1923, 2 ♀♀.

Possibly a race, as both have the blue-blackish scaling dominant, the borders beneath rather broad, that of hindwing little weakened posteriorly.

* 273. *Cleora latifasciata* (Warr.).

Poecilalcis latifasciata Warr., *Proc. Zool. Soc. Lond.*, p. 427 (1893) (Sikkim).

Boarmia eurydiscaria Hmpsn., *Journ., Bombay Nat. Hist. Soc.*, vol. xiv, p. 507 (1902) (Sikkim).

Hpimaw Fort, August 1923, 1 ♂.

Hampson (*Faun. Ind. Moths*, vol. iii, p. 281) misidentified Warren's *latifasciata*, sinking it to his own *euryzona* (Sect. *Gasterocome*). Consequently when the British Museum acquired the true *latifasciata* he assumed that it was a new species and redescribed it as *eurydiscaria*. I cannot find that the name *latifasciata* is pre-occupied, as Hampson (*loc. cit.*) indicates; probably he thought it too near his own *latifascia;* yet he has admitted both a *pallida* and a *pallidaria* in the self same genus (!).

* 274. *Cleora imbecilis* (Moore).

Pseudocoremia imbecilis Moore, *Lep. Coll. Atk.*, p. 241 (1888) (Darjiling).
Hpimaw Fort, June 1923, 1 ♂.

* 275. *Cleora venustularia* Walk.

Cleora venustularia Walk., *List. Lep. Ins.*, vol. xxxv, p. 1579 (1866) (N. India).
Htawgaw, August–September 1923, 1 ♂; Hpimaw Fort, August 1923, 3 ♂♂, 1 ♀.

Capt. Swann also sent two specimens which I take to be diminutive dark aberrations of this species: Htawgaw, August 1923, 1 ♀, August–September 1923, 1 ♂.

276. *Cleora decussata* Moore.

Cleora decussata Moore, *Proc. Zool. Soc. Lond.*, p. 628, Pl. xxxiii, Fig. 4 (1867) (Darjiling).
Hpimaw Fort, June 1923, 2 ♂♂.

277. *Cleora*, sp.

Htawgaw, August–September 1923, 1 ♂.

Too worn to make out. According to the structure it certainly belongs in the vicinity of *venustularia*, but I do not think it can be a weakly marked form (as diminutive as the dark ♂ noted above) of that species. Perhaps closer to *cincinna*, Warr. (*Nov. Zool.*, vol. xiii, p. 139) and *pammicra*, Prout (*Nov. Zool.*, vol. xxxii, p. 57).

278. *Cleora aagostigma*, sp. n.

♂, 22–23 mm.; ♀, 25–27. Near *venustularia* Walk., though smaller. Head and thorax pale brownish grey, only the metathorax blackened; the face almost white. Antenna of ♂ with pectinations about 3 (much as in *venustularia* or scarcely so long). Abdomen white, with some black-grey dorsal irroration and ill-defined subdorsal spots. Legs about as in *venustularia*.

Forewing in all the known examples with $SC^{1 \cdot 2}$ shortly stalked (in *venustularia* generally arising separate, but variable), SC^1 anastomosing shortly with C (3 examples) or free (paratype ♂); fovea large in the ♂, slightly indicated even in the ♀; white, with the dark irroration rather weaker than in *venustularia*, at least in the median area; Subbasal black mark much weaker; antemedian less oblique, with an appreciable brown line or shade proximally; cell-spot large, rather elongate, black, with the median shade either crossing it or touching it distally, but so much less strong as never to fuse with it; postmedian with the two outward curves weak, though slightly variable; shading in distal area not so heavy and variegated as in *venustularia* (the bluish element wanting); pale midterminal spot moderately developed; sometimes a rather strong dark cloud between the radials; termen as in *venustularia*; fringe more weakly chequered. *Hindwing* nearly as in *venustularia*, but with the postmedian line slightly more sinuous, ending more obliquely at abdominal margin.

Underside with the cell-spots strong, otherwise more weakly marked than in *venustularia*, the forewing much more uniformly blurred, the hindwing with postmedian line sometimes almost absolete, never strong.

Hpimaw Fort, August 9–13, 1923, type ♂ and paratype ♂, August 1923, 2 ♀♀.

Evidently close to *pammicra* Prout (*Nov. Zool.*, vol. xxxii, p. 57, Pahang), possibly a race, though the subcostal venation has not advanced so far in specialization; less small, the hindwing whiter, the subterminal on both wings less developed, etc.

* 279. *Cleora coniozona*, sp. n. (Pl. ii, Fig. 3).

♂, 28–30 mm. Structure about as in *jubata*, Thnbg. Face white, irrorated (especially on upper part) with black-grey. Palpus rather loose-haired, heavily mixed on outerside with black. Head, body and legs white, irrorated with black, the fore and midleg rather regularly banded.

Forewing with SC$^{1\cdot 2}$ shortly to extremely shortly stalked; white with black irroration; this irroration in the basal area moderately dense (except on fovea), in places slightly confluent, in median area almost uniform, in distal area rather more irregular; cell-spot large; lines indicated chiefly by costal marks and by dots or dashes on the veins, their position, however, rendered very distinct by non-irrorate bands of the white ground-colour on their reverse sides; median shade sometimes obsolete, sometimes indicated anteriorly, curved, meeting the postmedian dots about R^3; subterminal line irregular, in middle almost lost in a vague pale terminal patch some ill-defined black blotches proximal to the subterminal; interneural black terminal spots; fringe sharply chequered. *Hindwings* white, the irroration slight, except basally and abdominally; cell-spot moderately large; the beginning of an oblique line from abdominal margin close to tornus.

Underside similar, the forewing more clouded in cell, more whitish behind.

Hpimaw Fort, June 1923, type, August 9–13, 1923, 2 ♂♂, August 14–18, 1923, 1 ♂.

Variation slight, chiefly in the width of the median area.

* 280. *Cleora semiclarata* (Walk.).

Selidosema (?) *semiclarata* Walk., *List Lep. Ins.*, vol. xxiv, p. 1029 (1862) (Bhutan).

Htawgaw, March 1923, 1 ♀, April 4–10, 1923, 1 ♂, 1 ♀, April–May 1923, 3 ♂♂, September–October 1923, 1 ♂; Hpimaw Fort, August 1923, 1 ♀.

* 281. *Cleora perspicuata* (Moore).

Boarmia perspicuata Moore, *Proc. Zool. Soc. Lond.*, p. 630 (1867) (Bengal).

Htawgaw, April–May 1923, 5 ♂♂, 2 ♀♀, early July 1923, 1 ♂; Hpimaw Fort, June 1923, 13 ♂♂.

I am still very far from having completed my investigations into the species of the *admissaria* group, even for India; but I believe the above is the oldest name for the common moderately variable North Indian species. In addition to the series registered above, Capt. Swann sent a rather small ♂ and ♀ (Hpimaw Fort, June 1923, ♂, Laukhaung March 10, 1923, ♀) which may represent another aberration, or very likely a closely allied species. They are superficially extremely like *pleniferata* Walk. (*List Lep. Ins.*, vol. xxvi, p. 1538, Bhutan), having just the same blackish clouding between the antemedian and the median line; but the underside is different and the antenna and hindleg of the ♂ show structural divergence.

* 282. *Cleora incongruaria* (Leech).

Boarmia incongruaria Leech, *Ann. Mag. Nat. Hist.* (6), vol. xix, p. 425 (1897) (Omei-Shan), Hpimaw Fort, August 14–18, 1923, 2 ♂♂, 1 ♀.

* 283. *Cleora euphiles* Prout.

Cleora euphiles Prout, *Nov. Zool.*, vol. xxiii, p. 54 (1916) (Tibet).

Htawgaw, April–May 1923, 1 ♂, August 1923, 1 ♀.

* 284. *Cleora trigrapta*, sp. n.

♀, 31 mm. Face brown, mixed with black. Palpus about 1¼, rough scaled; brown, mixed on outerside with black; underside greyer.

Forewing with apex not acute, termen not very oblique, straightish between SC^5 and R^3, curved and faintly waved behind; SC^1 and SC^2 well free, M^1 closely approximated to R^3 at origin; proximal area russet, weakly irrorated with blackish and with a very ill-defined subbasal stripe; median area grey, the three lines rather strong, black; antemedian from costa at 4 mm. to hindmargin at 3 mm., very gently curved anteriorly, almost straight to SM^2, then rather oblique inward; median from costa slightly before middle, excurved (but weakened) where it crosses the elongate black cell-mark, gently incurved posteriorly; postmedian from costa at 9·5 mm. to hindmargin at 7 mm., bent at or just behind R^2; distal area russet, nearly clear proximally, much irrorated and clouded with blackish distally; subterminal line ill-defined except around R^3, where it forms a thickened white mark, a little inbent at the vein, oblique outward behind it; terminal line somewhat thickened between the veins; fringe weakly mottled. *Hindwing* with termen weakly subcrenulate, the inward curve between the radials more noticeable; whitish grey, suffused with darker grey, the general tone a little darker than in *Ectropis duplexa* Moore, only the costal area remaining pale; a median shade present, but only distinct posteriorly; cell-dot dark grey; postmedian line not strong, weakly bent in middle; subterminal indicated in whitish, irregularly crenate; terminal line and fringe as on forewing.

Both wings beneath whitish grey, strongly irrorated with dark grey; cell-mark of forewing reduced, of hindwing enlarged; lines of upperside reproduced in dark grey; an ill-defined pale shade just outside the postmedian; hindwing with traces of the subterminal.

Hpimaw Fort, August 14–18, 1923, type; Hparĕ, September 1923, a worn ab. (?), with the central band broadened anteriorly and narrowed posteriorly.

Probably related to *ningpoaria* Leech (*Ent. Supp.*, 1891, p. 52; Prout in *Seitz Macrolep.*, vol. iv, p. 373, Pl. 21c), which is in a measure transitional between the *Cleora* and *Ectropis* sections of the great *Boarmia* group.

* 285. *Cleora vatia*, sp. n.

♀, 30 mm. In shape and coloration remarkably like the preceding species, of which I at first thought it might be an extraordinary aberration.

Forewing with termen slightly more regularly curved and oblique; SC$^{1\cdot2}$ shortly stalked; antemedian line much more excurved; median less sinuous, at hindmargin nearer to postmedian than to antemedian; postmedian not outbent anteriorly, on the other hand incurved posteriorly, oblique outward to hindmargin; subterminal traceable throughout, enlarged into a roundish white spot (just over 1 mm. in diameter) in front of M^1 and a smaller one behind it; termen with black interneural spots. *Hindwing* rather darker than in *trigrapta*, not becoming whiter anteriorly; median shade obsolescent; postmedian thickened.

Underside also distinguishable by the course of the lines and by the subterminal white spots of the forewing.

Htawgaw, June 1923, the type only.

* 286. *Cleora cryptogonia*, sp. n. (Pl. ii, Fig. 7).

♂, 32–33 mm. Face with moderately appressed scales; blackish, upper and lower edges whitish. Palpus little over 1, blackish, with the base and the blunt distal extremity whitish. Vertex whitish, dark-irrorated; antenna dark grey, bipectinate to about ¾, the branches, except the first two and last few pairs, long, rather slender, heavily ciliated, the distal segments very shortly ciliated. Thorax grey; abdomen rather slender; pale grey, with dark dorsal belts, those of the first few segments broad and nearly black, sometimes almost confluent. Legs largely clouded with dark fuscous; hindtibia dilated, with hair-pencil.

Forewing shaped like a *Gnophos*; fovea strong, bounded distally on upperside by some black scaling; SC$^{1\cdot2}$ rather long-stalked, the stalk connate with, or arising from the base of SC$^{3\cdot5}$, connected by a backward bar with C; whitish drab, with brown irroration; cell-dot large; black costal spots at beginning of lines; the lines themselves rather weak; median exangled round cell-spot, then incurved; postmedian denticulate or subpunctiform, excurved about the radials, then oblique inward, angled inward at fold; an ill-defined brownish line or shade beyond; subterminal lunulate, except behind SM^2 (where it runs almost to tornus), filled in proximally with dark spots or shading; termen with black interneural dashes; fringe weakly spotted. *Hindwing* with cell-dot at least as large as on forewing; median shade angled outward in middle to coalesce with it, then incurved; postmedian lunulate-dentate, duplicated as on forewing.

Forewing beneath with large cell-spot, proximal suffusion, costal spots fairly well developed, median shade apparently crossing the cell-spot, postmedian punctiform, often weak, but developing into a rather broad shade between M^2 and hindmargin, and a solid dark border of about 3 mm. width. Hindwing with large cell-spot, the characteristic angled median shade as above, but standing out more sharply, the postmedian shadowy, the terminal shade (here rather subterminal) less strong than on forewing and only reaching radial fold. Both wings with termen and fringe as above.

Hpimaw Fort, August 9–13, 1923, type ♂ and another, August 14–18, 1923, 1 ♂.

Perhaps a form of '*Scotopteryx*' *subnigrata*, Warr. (*Nov. Zool.*, vol. viii, p. 34), founded on a single ♀ from Cachar, but it seems better to make the species known adequately, even at the risk of a synonym, than to make a premature union. Larger, the cell-spots larger, the postmedian beneath more obsolete, terminal band of hindwing beneath weaker ; venation different in that Warren's type has SC^{12} coincident, anastomosing at a point with C. Hampson's sinking (*Journ., Bombay Nat. Hist. Soc.*, vol. xiv, p. 505) of *subnigrata* to *serratilinea*, Warr. (*Ectropis*) is absurdly wrong ; there is no resemblance excepting a similarity of colouring and of the shape of the postmedian line.

* 287. *Cleora sericea* (Warr.).

Apophyga sericea Warr., *Proc. Zool. Soc. Lond.*, p. 418 (1893) (Sikkim).

Hpimaw Fort, June 1923, 3 ♂♂.

This very fine and apparently rare species is quite unlike any other in the genus and should perhaps be transferred to *Medasina*. In two of Capt. Swann's specimens SC^1 of the forewing arises from the cell and is free, in the other it arises from C and does not touch SC^2, i.e. is as in normal *Medasina*.

* 288. *Boarmia melanosticta catotæniaria* (Pouj.).

Selidosema catotæniaria Pouj., *Ann. Soc. Ent. Fr.*, p. 313 (*—ata*, p. 316, Pl. vii, Figs. 15, 15 *a*) (1895) (Moupin).

Hpimaw Fort, June 1923, 2 ♂♂.

Poujade's species is evidently the same as *melanosticta*, Hmpsn. (*Faun. Ind. Moths*, vol. iii, p. 266, Sikkim), but the few specimens yet known appear to show some racial difference and Capt. Swann's specimens agree with them rather than with the Sikkim form.

* 289. *Boarmia retrahens* (Moore).

Calicha retrahens Moore, *Lep. Coll. Atk.*, p. 236 (1888) (Sikkim).

Hpimaw Fort, June 1923, 1 ♂.

* 290. *Boarmia fimbriata* (Moore).

Cleora fimbriata Moore, *Proc. Zool. Soc. Lond.*, p. 628 (1867) (Bengal).

Htawgaw, early July 1923, 1 ♂.

A small and rather dull-coloured specimen, apparently referable here.

291. *Boarmia*, sp.

Htawgaw, April–May 1923, 1 ♂ ; Hparè, September 1923, 1 ♂ (small).

Apparently a new species, but both—especially the Hparè specimen—too worn to describe fully. Palpus short, pectinations long, reaching to near end of shaft, build rather slender, abdominal spine rather short, fovea not strong, colour rather pale, cell-dots small, median line (shade) fairly strong, postmedian markedly crenulate, especially posteriorly, subterminal fairly broad, accompanied by browner shadings.

* 292. *Boarmia virguncula*, sp. n. (Pl. ii, Fig. 4).

♂, 22–24 mm. ; ♀, 26–27. Head whitish fuscous, irrorated with blackish ; palpus less than 1½, heavily scaled, on outerside predominantly blackish. Antennal pectinations moderately robust (slightly thickening distally), not long, the longest scarcely 3, the series shortening gradually, becoming mere teeth before the 30th joint, about which they cease. Thorax above fuscous, in front (with collar) more ochreous brown, beneath whitish ; abdomen whitish, with blackish irroration, which above tends to form anterior segmental belts. Foreleg dark, with ends of joints whitish ; hindtibia in ♂ with slender hair-pencil.

Forewing with $SC^{1 \cdot 2}$ coincident, almost always anastomosing at a point or shortly with C, very rarely also with $SC^{3 \cdot 4}$; fovea developed ; dirty white, sparsely irrorated with black and more copiously with brown, the latter colour forming the markings ; antemedian line double, sometimes a good deal overlaid with black, slightly sinuous, from cell-fold hindward strongly oblique ; median shade generally weak except at costa, excurved round the small black cell-dot ; postmedian usually strengthened in places, chiefly on the veins, rather strongly inbent at fold ; an ill-defined brown shade-line just beyond ; subterminal crenulate, interrupted about R^3 and M^1 by a more or less developed whitish patch ; proximal subterminal shades well developed (more or less mixed with black) costally, radially and behind M^1, the radial shade especially strong, as a pair of confluent spots ; termen with subtriangular black interneural spots ; fringe feebly chequered. *Hindwing* with cell-dot and markings beyond much as on forewing, the subterminal shades on an average less strong.

Forewing beneath, except at hindmargin, with smoky suffusion, which is commonly so strong as to obscure the markings, leaving only the cell-mark, a rather large black costal spot representing the median line and a smaller one the postmedian ; when the smoky shade is less developed (chiefly in ♀♀), a dark band occupying the distal area. Hindwing dirty whitish, with sharply black cell-dot and ill-defined wavy median and (double) postmedian lines ; terminal black marks as above.

Htawgaw, April–May 1923, 14 ♂♂, 7 ♀♀, August–September 1923, 1 ♂ (rather small) ; Laukhaung, April–May 1923, 1 ♀.

An inconspicuous little species, but not specially reminiscent of any one hitherto known, unless possibly *latifascia* Hmpsn. (*Ill. Het.*, vol. viii, p. 106, Pl. cl, Fig. 4), which has larger cell-spots, rather proximally placed and more S-shaped postmedian and quite different underside.

A damaged ♀ from Hpimaw Fort, August 14–18, 1923, may possibly, according to its structure and essential markings, be a giant form of *virguncula*, more likely another allied species.

* 293. *Prochasma dentilinea* (Warr.).

Psilalcis dentilinea Warr., *Proc. Zool. Soc. Lond.*, p. 431 (1893) (Sikkim).
Boarmia squalida, Wileman, *The Entom.*, vol. xlviii, p. 292 (1915) (syn. n.) (Formosa).

Htawgaw, early July 1923, 1 ♂ ; Hparê, September 1923, 2 ♂♂, 2 ♀♀.

Range : North India, Pahang, Formosa.

Certainly congeneric with *mimica*, Warr., the type of *Prochasma*, having the same metallic metathoracic tuft, etc. ; but I do not think Hampson (*Journ., Bombay Nat. Hist. Soc.*, vol. xi, p. 724) is right in actually sinking *mimica*.

* 294. *Prochasma albimonilis*, sp. n.

♂♀, 26–27 mm. Head and body pale grey, densely irrorated with blackish fuscous. Legs (especially the first two pairs) with pale rings on a dark ground. Abdomen of ♂ without spine, but with a comb of bristles on the 3rd sternite and hairy from the 4th to the 7th.

Forewing with termen slightly more curved than in average *dentilinea* ; SC^1 arising from C, in the ♂ anastomosing with SC^2 ; pale drab, densely and almost uniformly irrorated with blackish ; cell-spot and some subterminal maculation (most prominent at costa, radials and hindmargin) black ; a very slender and indistinct sinuous whitish line (less deeply sinuate than in *dentilinea*) proximal to the almost imperceptible antemedian ; a row of white interneural spots (the one at submedian fold crescentic) distally to the postmedian, which is otherwise hardly indicated except in the vein-teeth which separate them ; this line also a little more direct than in *dentilinea*, except between fold and SM^2, where it is strongly oblique outward ; subterminal fine, indistinct and interrupted ; terminal line fine ; fringe weakly mottled. *Hindwing* with termen well rounded, looking slightly fuller than in *dentilinea ;* slightly less dark than forewing, marked with cell-dot, weak median shade, sinuous postmedian (very near the cell-spot, fairly strong posteriorly) and subterminal shade (widened a little between the radials).

Underside with similar markings, the forewing, however, without the antemedian and subterminal lines, the distal darkening more uniform throughout.

Htawgaw, July 1923, type ♂, August 1923, allotype ♀.

* 295. *Lophobates ochreicostata* Warr.

Lophobates ochreicostata Warr., *Nov. Zool.*, vol. vii, p. 54 (1899) (Khasis).
Hpimaw Fort, August 14–18, 1923, 1 ♂.

296. *Hemerophila retractaria* Moore.

Hemerophila retractaria Moore, *Proc. Zool. Soc. Lond.*, p. 27, Pl. xxxii, Fig. 7 (1867) (Darjiling).

Hparè, August-September 1923, 1 ♀.

Probably belongs to this species, of which the eastern race, if tenable, should be known as *r. lignata*, Warr. (*Nov. Zool.*, vol. i, p. 680, Khasis). But the ♀♀ of this group of *Hemerophila* are confusingly similar and I do not yet know that of *subpilosa*, Warr.

* 297. *Hemerophila cuprearia* Moore.

Hemerophila cuprearia, Moore, *Proc. Zool. Soc. Lond.*, p. 626 (1867) (N.E. Bengal).

Htawgaw, September-October 1923, 1 ♀.

Darker than the Sikkim pair in coll. Brit. Mus.

* 298. *Hirasa scripturaria* (Walk.).

Tephrosia scripturaria Walk., *List Lep. Ins.*, vol. xxxv, p. 1590 (1866) ('Java,' in err. [N. India]).

Hpimaw Fort, September 18, 1922, 1 ♂, June 1923, 1 ♂, August 14–18, 1923, 1 ♂.

Only known from North India and Burma. Walker's originals are labelled 'N. India', purchased from Janson, and the published data are due to some unexplained muddle.

* 299. *Hirasa plagiochorda*, sp. n. (Pl. ii, Fig. 13).

♂, 39 mm. Near the preceding. Antennal structure the same. Face with the dark upper part more extended. Body and wings slightly darker and more uniform brown.

Forewing slightly narrower; antemedian line posteriorly more oblique inward, very gently and almost regularly curved; cell-dot smaller; median line almost touching the cell-dot, instead of taking the wide outward sweep beyond it; postmedian anteriorly similar to that of *scripturaria*, the angle at R^1 acute, the subsequent course almost straight and oblique to middle of hindmargin; an interrupted line or shade from angle of postmedian to termen behind SC^5, meeting the dark fringe-spot (which is rarely so well developed in *scripturaria*) opposite SC^5. *Hindwing* with cell-dot minute, the weak median line just *proximal* to it; postmedian line much straighter than in *scripturaria.*

Haparè, September 1923, type. Khasis, September 1895, 1 ♂ in coll. Tring Mus.

H. scripturaria from Hpimaw Fort does not differ markedly from Darjiling and Khasi specimens.

* 300. *Hirasa contubernalis* Moore.

Hirasa contubernalis Moore, *Lep. Coll. Atk.*, p. 238 (1888) (Khasis).

Htawgaw, April–May 1923, 1 ♂; Hpimaw Fort, September 19, 1922, 1 ♂, June 1923, 2 ♂♂; Kangfang, June 1923, 1 ♂.

The Kangfang specimen is a dark aberration.

* 301. *Blepharoctenucha virescens* (Butl.).

Hemerophila virescens Butl., *Ann. Mag. Nat. Hist.* (5) vi. 126 (1880) (Darjiling).

Htawgaw, April–May 1923, ♂.

* 302. *Sysstema aulotis*, sp. n. (Pl. ii, Fig. 19).

♀, 24–28 mm. Head and body whitish buff, mixed with dark fuscous.

Forewing whitish buff, so strongly irrorated and clouded with dark fuscous as to make this appear as the ground colour, two clear bands of about 1 mm. breadth remaining; cell-spot large, black; first band anteriorly slightly excurved or outbent; second between R^2 and M^2 very strongly excurved, approaching termen; subterminal line very close to termen, slender and imperfect, the area between it and the postmedian band slightly darkened; a thick orange terminal line, with some irregular black interneural marks, especially anteriorly : fringe darker proximally than distally, slightly mottled. *Hindwing* slightly less densely irrorated than forewing ; first band wanting ; second shaped as on forewing, rather narrower and less sharply defined ; subterminal with the dark shading chiefly developed between the radials and from M^2 to tornus ; termen and fringe as on forewing.

Upperside similar.

Hparê, September 1923, 6 ♀♀ ; Kangfang, September–October 1923, 1 ♀.

Also occurs in the Naga Hills and (in a rather larger form) in Sikkim ; treated by Hampson (*Faun. Ind. Moths*, vol. iii, p. 278) as an aberrant *semicirculata* Moore.

* 303. *Sysstema semicirculata* (Moore).

Eupithecia semicirculata Moore, *Proc. Zool. Soc. Lond.*, p. 654 (1867).

Htawgaw, April–May 1923, 2 ♂♂, 1 ♀ ; Hpimaw Fort, June 1923, 5 ♀♀.

* 304. *Sysstema longiplaga* Prout.

Sysstema longiplaga, Prout, *Nov. Zool.*, vol. xxx, p. 211 (1923) (Sikkim).

Htawgaw, April–May 1923, 1 ♂, 2 ♀♀, August–September 1923, 2 ♀♀.

Previously known from Sikkim and Assam.

* 305. *Sysstema pauxilla*, sp. n.

♂, 20 mm. Head and body white-grey, irrorated (the abdomen and underside quite weakly) with brown ; 7th sternite apparently black, covered with dense hair, which arises from the posterior edge of the 6th sternite.

Forewing with cell $\frac{1}{2}$; SC^1 arising further down the stalk of $SC^{3\cdot 5}$ than in the other *Sysstema* species, anastomosing with C ; whitish, densely irrorated with fuscous ; cell-dot black ; median shade just proximal to it, apparently as in *semicirculata* Moore but very weak ; an ill-defined band of the ground-colour just beyond, on which is traceable (chiefly as spots at costa and hind-margin and dots on the veins) a slightly sinuous postmedian line with a marked projection inward at fold ; terminal area with an ill-defined dark cloud in front of R^3, weakening to costa, and a slighter cloud near tornus ; weak indications of the narrow orange terminal band which characterizes the allies, the black interneural spots strong ; fringe mostly dark. *Hindwing* with the same markings, the median shade a little stronger, well proximal to the cell-dot, the pale band extending from median to postmedian ; an orange abdominal-marginal streak.

Underside more weakly marked, but with the proximal and distal areas of the forewing fairly strongly darkened.

Htawgaw, April–May 1923, the type only. A rubbed ♀ from Darjiling, without abdomen, is in the Tring Museum.

306. *Medasina combustaria* (Walk.).

Gnophos combustaria Walk., *List Lep. Ins.*, vol. xxxv, p. 1597 (1866) (N. India).

Htawgaw, August–September 1923, 1 ♀.

Rather aberrant, but I think referable here.

* 307. *Medasina objectaria* (Walk.).

Boarmia objectaria Walk., *List Lep. Ins.*, vol. xxxv, p. 1583 (1866) (N. India).

Hparê, August–September 1923, 1 ♀.

Perhaps confined to North India and Burma. Hampson's citation of Poona (*Faun. Ind. Moths*, vol. iii, p. 284) is due to his erroneous sinking of *gleba*, Swinh.

* 308. *Medasina tephrosiaria* (Warr.).

Lassaba tephrosiaria Warr., *Nov. Zool.*, vol. iii, p. 135 (1896) (Khasis).

Htawgaw, April–May 1923, 1 ♀.

Previously only known to me from a few Khasi specimens. Certainly does not sink to *mucidaria*, Walk. (cf. Hampson, *Journ.*, *Bombay Nat. Hist. Soc.*, vol. xi, p. 724, as *tephrosiaria*).

* 309. *Medasina parallela*, sp. n.

♂, 65 mm. Quite near *mucidaria* Walk. (*List Lep. Ins.*, vol. xxxv, p. 1581), differing as follows:

Abdomen more slender, the hair-tufts less strong.

Forewing slightly more elongate; antemedian line more direct, without the inward curve and acute angulation subcostally or the long tooth outward at fold; postmedian likewise less irregular than in most *mucidaria*; the bright shades proximally to antemedian and distally to postmedian narrow but rather strong, dotted with black on most of the veins. *Hindwing* with termen not quite so deeply crenulate as in *mucidaria*; proximal markings weak; postmedian line scarcely sinuous, the shade outside it rather well-defined and regular.

Forewing beneath with cell-mark enlarged, slightly ocellated; proximal part more suffused with brown (especially anteriorly) and more irrorated with grey than in *mucidaria*; subterminal band almost obsolete (usually strong in *mucidaria*, but there very variable). Hindwing slightly more suffused with brown than in *mucidaria*; subterminal band almost obsolete.

Hpimaw Fort, June 1923, the type only.

* 310. *Medasina basistrigaria* (Moore).

Hemerophila basistrigaria Moore, *Proc. Zool. Soc. Lond.*, p. 626 (1867) (Darjiling).

Htawgaw, October 14, 1923, 1 ♀.

* 311. *Medasina lasiochora* sp. n. (Pl. ii, Fig. 11).

♂ ♀, 42-43 mm. Near *basistrigaria*, Moore. Rather smaller; much darker and less reddish, even the median area—which, as in the allies, is the least dark—being heavily strigulated; hindtibia of ♂ less strongly dilated, the hair-pencil slenderer.

Forewing with median shade developed from costa to M, bent outside the cell-mark or more or less suffusing with it; postmedian rather more excurved radially, straighter posteriorly. *Hindwing* with the prominence at R^3-M^1 a little broader, scarcely so long.

Underside with the dark borders more developed than in *basistrigaria* (in the ♀ almost complete), but little noticeable against the general darkening; hindwing in the ♂ with a small scaleless patch between M and the proximal part of M^2, suberect sexual hair arising here in the vicinity of these veins.

Hpimaw Fort, August 9-13 1923, type ♂, August 14-18, 1923, allotype ♀.

* 312. *Medasina livida* (Warr.).

Deinotrichia livida Warr., *Proc. Zool. Soc. Lond.* p. 419 (1893) (Sikkim.).

Hpimaw Fort, June 1923, 1 ♂; Fenshuiling Pass (4 miles from), early July 1923, 1 ♀.

313. *Medasina albidaria* (Walk.).

Boarmia albidaria Walk., *List Lep. Ins.*, vol. xxxv, p. 1582 (1866) (N. India).

Htawgaw, early July 1923, 1 ♂, July 17, 1923, 1 ♀.

The ♀ is an aberration with stronger grey irroration and heavier markings. The British Museum has a similar specimen from Omei-shan.

Range: North-west India to China and Formosa.

* 314. *Micrabraxas anisonoma*, sp. n. (Plate ii, Fig. 9).

♂, 36 mm. Face whitish, with some loose fuscescent hair, which below forms a small cone. Palpus 1¼, slender, 2nd joint somewhat tufted above; whitish, tinged with brown, the terminal joint more fuscous. Vertex fuscous. Antenna simple, Thorax whitish, above mixed with brown. Abdomen slender, the genitalia elongate; beneath whitish, above browner and with ill-defined fuscous belts at the ends of the segments. Legs more or less tinged with brown; hindtibia dilated with hair-pencil, abdominal spine short.

Forewing not broad; SC^1 well free, SC^2 from stalk of SC^{3-5}; a small fovea present; scaling smooth; brown, irrorated with dark fuscous; markings consisting of white, fuscous-edged spots, those on costa tinged with buff; a rather large one in cell near its end, confluent with a moderate costal;

another behind the base of M^2 ; irregular postmedian and subterminal series ; a moderate apical ; small paired sabbasal and median costal spots and an ill-defined costal one between postmedian and subterminal. *Hindwing* with termen slightly undulate ; anteriorly white, posteriorly brown, the colours not sharply defined, the brown area somewhat mottled with white and cut by incomplete white bands ; irregular subterminal white spots.

Underside similar, but with more white, especially at hindmargin of forewing ; both wings with conspicuous black cell-spot.

Hpimaw Fort, August 9–13, 1923, the type only.

Affinities obscure. Neither of the three smooth-scaled genera with similar venation which might be taken into account—*Micrabraxas*, *Loxaspilates*, *Xenographia*—normally develops a fovea, but it seems to have most points in common with *Micrabraxas*. *Lozogramma imitata* Bastelb. (*Ent. Zeit. Stuttg.* xxiii, 34) may be related, though not closely, being broader-winged, with rather shorter palpi, no tibial hair-pencil and I think no fovea.

315. *Arichanna ramosa* (Walk.).

Scotosia ramosa Walk., *List Lep. Ins.*, vol. xxxv, p. 1688 (1866) (N. India).

Htawgaw, June 1923, 1 ♂.

Inhabits North India, Tibet and West and Central China ; perhaps susceptible of racial subdivision.

* 316. *Aricharna plagifera* (Walk.).

Scotosia plagifera Walk., *List Lep. Ins.*, vol. xxxv, p. 1686 (1866) (N. India).

Hpimaw Fort, June 1923, 3 ♂♂.

* 317. *Arichanna transectata* (Walk).

Rhyparia transectata Walk., *List Lep. Ins.*, vol. xxiv, p. 1112 (1862) (Himalayas [Darjiling]).

Hpimaw Fort, June 1923, 1 ♀.

Hampson (*Journ.*, *Bombay Nat. Hist. Soc.*, vol. xviii, p. 43) has satisfactorily cleared up the confusion into which he earlier fell regarding this apparently rare species. He failed, however, to correct the statement (*Faun. Ind. Moths*, vol. iii, p. 294) that Walker's type had the head and thorax of a ♂ attached to the abdomen of a ♀; like Walker, who calls the specimen a 'male', he was presumably misled by the pectinate ♀ antenna of the species—a very exceptional character in the genus—and he must have neglected to examine the retinaculum.

318. *Icterodes jaguarinaria* (Oberth).

Rhyparia jaguarinaria Oberth., *Et. Ent.*, vi, p. 17, Pl. ix. Fig. 1 (1881) (Kwei-chow).

Htawgaw, April–May 1923, 1 ♀, June 1923, 2 ♀♀.

Range : Nagas to West China. Hampson's paragraph on 'the typical Japanese and Chinese form' refers to *jaguararia* Guen. (*Spec. Gén. Lép.*, vol. x, p. 198) and its Japanese race *gaschkevitchii* Motch. (*Bull. Mosc.*, vol. xxxix, Part 1, page 197).

* 319. *Abraxas aphorista*, sp. n.

♂, 52 mm. Head black. Antennal ciliation apparently about 1 (rather mouldy). Collar and front of thorax orange ; wing-tegula orange, with one or two black spots and a few white scales. Thorax behind (with metathoracic crest) blackish. Abdomen orange, the elongate dorsal black spots rather large, broad behind, the subdorsal pairs also rather large, especially the posterior on each segment ; the interrupted lateral line well developed as also the ventral pairs of spots. Hindtibia moderately dilated.

Forewing more elongate than normal, almost as in true *leopardina*, Koll. (*Hügel's Kaschmir*, vol. iv, p. 490, Masuri, etc.), but with the termen a little less straight (appreciably bent in middle) ; SC^1 running into C, SC^2 closely approaching $SC^{3 \cdot 4}$ at branching of SC^5 ; white, with the essential markings of the *leopardina* group ; basal patch not very light, tolerably uniform, its distal edge not excavated behind middle ; grey median shade (probably rather variable) irregularly triangular, at hindmargin about 1·5 mm. wide, at costa about 10 mm. (almost meeting basal patch and postmedian band), but with its anterior part slightly broken by irregular white spots or dots, notably with one in end of cell, partly isolating the cell-spot; postmedian band fairly broad, resolvable on attention into a double row of almost entirely confluent spots, the proximal row slightly the darker and more sharply bent at radials, so as to separate slightly from the distal row anteriorly; the hindmarginal patch slightly longer and (anteriorly) narrower than in Hampson's Fig. 141 (*Faun. Ind. Moths*, vol. iii, p. 299); distal area rather more heavily spotted than in the cited figure. *Hindwing* decidedly elongate; costa swollen at base, but less extreme than in *leopardina*; termen appreciably crenulate, specially through having a rather noticeable concavity between R^1 and R^3; white, with grey spots; a small dark mark in base of cell; antemedian represented by small spots at costa, at furcation of SC^2-R^1 and (confluent) at fold and abdominal margin; postmedian series normal, fairly large, accompanied distally (especially on left hindwing) by some slight, asymmetrical dots or small spots; posterior patch rather broad (about 4 mm.) at abdominal margin, narrowing; terminal spots lunulate, scarcely separated by the veins.

Underside with base and retinaculum pale orange; the grey markings slightly darker than above; the 'olive-fulvous' patches of upperside not differentiated in colouring.

Kangfang, June 1923, the type only.

Near to *leopardina* (*vera*), in which Hampson has merged a large number of dissonant forms. Possibly a race—but with the exception of a single doubtful example from Bhutan—I have not previously seen anything *leopardina*-like outside the North west Himalayas.

320. *Abraxas martaria* Guen.

Abraxas martaria Guen., *Spec. Gén. Lép.* x, vol. i, p. 205 (1858) (N. India).

Htawgaw, April-May, 1923, 1 ♂, 1 ♀, June 1923, 1 ♂, 1 ♀, early July 1923, 1♂; ? Hpimaw Fort, June 1923, 1 ♀, August 9-13, 1923, 1 ♀.

The Htawgaw ♀♀ are typical; the ♂♂, especially the first two have more white on the forewing, approaching (f. ?) *pancinotata*, Warr. (*Nov. Zool.*, vol. i, p. 417). The Hpimaw Fort specimens, in particular the June one, are strongly marked, the basal patch, subtornal patches, etc., having nearly the colouring and in some measure the enlargement of the corresponding markings of *illuminata* Warr.

321. *Abroxas illuminata* Warr.

Abraxas illuminata, Warr., *Nov. Zool.*, vol. i, p. 417 (1894) (Sikkim).

Htawgaw, early July 1923, 1 ♀.

Range: Sikkim to Hainan and West China.

* 322. *Abraxas suffusa*, Warr. (form ?).

Abraxas suffusa Warr., *Nov. Zool.*, vol. i, p. 417 (1894) (Tibet).

Hpimaw Fort, August 9-13, 1923, 1 ♀, August 14-18, 1923, 3 ♀♀.

All the Hpimaw examples have the median shade of the forewing obsolete from the fold hindward and further differ from all Warren's species in the group (*Nov. Zool.*, vol. i, pp. 419-419) in having the basal patch not at all notched or indented at the fold. Probably an undescribed species, but until Warren's have been more thoroughly analysed I am loth to add to the number, particularly where the ♂ is wanting.

* 323. *Abraxas pusilla* Butl.

Abraxas pusilla Butl., *Ann. Mag. Nat. Hist.* (5) vol. vi, p. 225 (1880) (Darjiling).

Htawgaw, April-May, 1923, 1 ♂, July, 2 ♂♂, 2 ♀♀; Hpimaw Fort, August 14-18, 1923, 1 ♂.

The species is common in Sikkim and is recorded also from Nepal, but does not appear to be very widely distributed. The Burmese specimens may represent a race, being on the average more sharply marked, the forewing with developed mid-terminal spot, etc.

324. *Abraxas metamorpha sinicaria* Leech.

* *Abraxas sinicaria*, Leech, *Ann. Mag. Nat. Hist.* (6) vol. xix, p. 446 (1897) (Central China).

Hpimaw Fort, August 1922, 1 ♂, August 9–13, 1923, 6 ♂♂, 1 ♀, August 14–18, 1923, 6 ♂♂, 4 ♀♀ ; Hparê, early September 1923, 3 ♀♀.

This series is moderately variable, but quite homogeneous in all essentials and tends to connect *sinicaria* Leech (Central to West China) with the less dark-marked Sikkim *metamorpha* Warr. (*Proc. Zool. Soc. Lond.* 1893, p. 392) = *conferta* Swinh. (*Ann. Mag. Nat. Hist.* (6) vol. xii, p. 153, syn. nov.). The latter remains scarce in our collections and it is not unlikely, considering the known inconstancy of *Abraxas*, that more adequate material will show even the racial separation to be untenable. Swinhoe's type is a more weakly marked form than Warren's and Hampson did not notice the specific identity. One or two of the less inconstant characters may be here mentioned, in order to elucidate the differentiation of the following species. Base of forewing a good deal mixed with orange, the subbasal black dot on SM^2 only 1 or 2 mm. from base, succeeded by a comparatively clean white submedian area, the central maculation of the wing being chiefly anterior ; postmedian band rarely forking anteriorly, the subapical costal spot being generally separated from it by a white line, or confluent with it at costa only ; hindwing rarely with the maculation copious, the curved postmedian series generally standing out sharply, placed about midway between cell and termen, only duplicated in posterior part, often only (except for a costal dot) by a heavy mark at abdominal margin ; median spot on abdominal margin about central.

* 325. *Abraxas metabasis*, sp. n.

♂, 44–46 mm. Distinguished from *metamorpha* as follows :—

Forewing in basal area with very little orange admixture ; the black maculation at end of this area formed into an irregular band which is about 2 mm. wide at costa (3–5 mm. from base), runs obliquely outward to cell-fold, is here acutely angled, becomes narrower and runs very obliquely inward to submedian fold, nearly meeting an equally oblique mark on SM^2 about 3 mm. from base ; central area with the speckling pretty uniform anteriorly and posteriorly ; postmedian double band more sinuate than in *metamorpha* or at least appearing so in its posterior half, its outer element running more obliquely to hindmargin, which it reaches quite near tornus ; this double band divaricating costally, so as to form a thick, rather irregular V ; subterminal region less clouded, the terminal spots at radials well separated from the postmedian ; terminal spot in cellule 7 minute, apical fringe clean white. *Hindwing* more copiously dotted than in *metamorpha* ; median spot of abdominal margin well behind middle ; postmedian spots nearer to termen, smaller, but (except anteriorly) double or multiple, at hindmargin more oblique outward, scarcely accompanied by any orange scaling ; apical end of termen immaculate.

Hpimaw Fort, June 1923, 1 ♂, early July 1923, 1 ♂, August 1923, 1 ♂ (type), August 9–13, 1923, 1 ♂ (more heavily black-marked).

In spite of the apparent agreement in structure (unless the antennal ciliation be slightly shorter—scarcely over 1, as against $1\frac{1}{4}$–$1\frac{1}{2}$), I think this can hardly be a form of the preceding ; the facies is so distinctive that the eye rejects the union.

* 326. *Abraxas picaria* Moore.

Abraxas picaria Moore, *Proc. Zool. Soc. Lond.* p. 652 (1867) (Darjiling).

Hpimaw Fort, August 14–18 1924, 1 ♂.

Aberrant in having the hindwing above more uniformly speckled throughout and the yellow band obsolete ; beneath typical.

Ab. *semilugens*, Warr., *Proc. Zool. Soc. Lond.*, 1893, p. 393 (Sikkim) I am inclined to agree with Hampson in referring here.

Hparê, September 1923, 1 ♂.

Capt. Swann's specimen is aberrant in the hindwing in a similar manner to the preceding, but also in having the cell-spot reduced and the yellow band wanting on *both* surfaces. Two Tonglo specimens in coll. Tring Mus. of otherwise typical *picaria*, have similarly reduced cell-spot of hindwing.

It is very doubtful whether the true *picaria* occurs in China, the variable species recorded by Leech (*Ann. Mag. Nat. Hist.* (6), vol. xix. pp. 446–447) being probably different. It may be added that Moore's own ' type ♀ ' (allotype) also belonged to a different species, namely *metamorpha*.

327. *Abraxas dichostata*, sp. n.

♂ ♀, 44–48 mm. Also near *metamorpha*, agreeing in structure. Differing as follows :—

Forewing with costa slightly more shouldered at base, termen in ♂ slightly less oblique anteriorly ; the dark markings in all the known examples copious, but not very intense, rather black-grey than black ; basal area, as in *metabasis*, with very little orange, but formed more as in *metamorpha*, commonly with a similar, but more restricted, white area outside it posteriorly ; median shade complete, anteriorly broad, just *proximal* to the cell-spot posteriorly parallel with the postmedian, more or less connected with basal patch by longitudinal dark shading which occupies most of the rest of the cell ; postmedian band almost complete, only macular or subinterrupted about the radials, anteriorly rather regularly curved, posteriorly less incurved than in the allies, keeping well removed from median ; the orange line wanting ; distal area as in exceptionally heavily clouded examples of *metamorpha*. *Hindwing* rather variable much as in *metamorpha* except for the absence of yellow postmedian mark at abdominal margin ; postmedian single throughout or duplicated anteriorly as well as posteriorly, its spots at abdominal margin little expanded, terminal marks longer than in *metamorpha*, between SC^2 and R^3 confluent.

Htawgaw, August 22 1922, 1 ♂, September 16, 1972, 1 ♂ (type), August-September, 1923, 1 ♂, 1 ♀.

328. *Dilophodes elegans* (Butl.)

Abraxas elegans Butl., *Ill. Het.*, vol. ii, p. 53, Pl. xxxvii, Fig. 6 (1878) (Japan).

Hpimaw Fort, August 14–18, 1923, 1 ♂, 2 ♀♀ ; Hparê, early September 1923, 1 ♂.

We have here perhaps a meeting-place between typical *elegans* and its Khasi race *khasiana* Swinh. (*Tr. Ent. Soc. Lond.*, 1892, p. 17), which are not quite so sharply delimited as Swinhœ (*Ann. Mag. Nat. Hist.* (8), vol. xviii, p. 220) assumes. The Hpimaw specimens all have the black markings heavy, more or less confluent, recalling the Japanese name-type ; the one from Hparê more approaches *e. khasiana*, particularly on the hindwing, which has a very small cell-spot, narrowed subterminal patch at abdominal margin and subterminal spot at radial fold well detached from termen.

The species is also known from China and Formosa and another race (?) from the Malay Peninsula.

* 329. *Percnia felinaria* Guen.

Percnia felinaria, Guca, *Spec. Gén. Lép.*, vol. x., p. 216, Pl. 19, Gg. 1 (1858 (' Central India.')

Hpimaw Fort, June 1923, 1 ♂.

Rather smaller than the normal Assamese form, with somewhat reduced markings, perhaps a new race or closely related species. The loss of the shadowy series of spots just outside the postmedian, together with the shape of the subterminal, even suggests that it may be nearer to *belluaria*, Guen, but the wings are not so narrow, the fovaa not exaggerated, the tone both above and beneath virtually that of *felinaria*.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY)

BY

T. R. Bell, c.i.e., i.f.s. (Retd.)

Part XXXVIII

(*Continued from page 686 of this Volume*)

Genus 31.—Gegenes

Imago.—A single species—see below.

Antennæ.—Short, less than half the costa of forewing; club robust, with a minute crook.

Palpi.—With the second joint densely scaled, the third joint short, porrect, nearly hidden amongst the scaling.

Hind tibiæ.—With two pairs of spurs; quite naked in *nostradamas.*

Forewing.—With vein 12 very short, ending on costa much before end of cell; the cell long, nearly two-thirds the length of costa; top discocellular minute, barely distinguishable, outwardly-oblique; the middle and lower discocellular in an inwardly-oblique line that is quite straight, the lower very short; vein 5 from close to 4, vein 3 from close to lower end of cell, 2 from about a fourth before the end; wing long and narrow; costa arched near base, then almost straight to apex which is somewhat acute; outer margin somewhat convex, oblique, shorter than hinder margin.

Hindwing.—Vein 7 emitted shortly before end of cell; discocellulars outwardly-oblique, faint; 5 absent; 3 from close to lower end of cell, 2 from about twice as far from 3 as 3 is from end; lower margin of cell slightly bent upwards at its end; costa highly arched at its base; apex rounded but well-pronounced; outer margin evenly convex and slightly emarginate between veins 2 and 1*b*.

Egg.—Not known.

Larva, pupa, habits.—See below as there is only a single species, any way in India.

232. **Gegenes nostradamas** (F.).—Male. *Upperside* brown of a medium shade with slight ochreous shade outwards or decidedly ochreous-brown with a slight bronzy tint. Forewing with a darkish suffusion on a little more than the basal half, merging into the paler outer portion of the wing that has a slight bronzy tint. Hindwing with a paler dark suffusion on the basal portion. No markings on either wing or a series of discal dots in interspaces 1 to 5 of which the one in 2 is large, the others very small and a series of three subapical dots in interspaces 6, 7, 8 of the usual type; that is, the subapical three are in an outwardly-oblique, slightly curved line and the discal in an inwardly-oblique more or less straight line from close to the lowest subapical spot. All of these dots generally rather obscure, some of them often wanting or the whole lot completely absent as the case may be. *Underside* pale greyish-brown with the spots as on upperside on the forewing. Antennæ black spotted with white, that is the white exists as broad bases to the joints that get quite narrow on the top of shaft and even disappear leaving the whole upperside black; the club black above with the tip red and the base whitish, below the club has the basal half white and the whole of the distal half including tip red. Palpi white with the third joint the colour of wings. The head and body are the same colour as the wings on the upperside; beneath pure-white or very slightly ochreous, the legs slightly brownish-ochreous on the tarsi.—Female with the *upperside* duller, paler-brown than the male, without darker basal

suffusion. Forewing with the spots much larger and more distinct than in the male as a rule, there being an extra little dot present in the upper part of interspace 1. Hindwing unmarked as in the male. *Underside* as in the male, the spots as on upperside. *Cilia* of the forewing cinereous white with base the colour of the upperside of wing, of the hindwing similar, the base rather broader; on the undersides of both wings the cilia are concolorous with the wings, that is even the bases are very pale. Expanse: 25 mm. to 30 mm. the female always the larger.

Larva.—This is very similar to that of *Chapra mathias* in the *shape* and general appearance; the body is thickest in the middle, with the ventrum flattened, the dorsal line highest in middle sloping to both ends; the anal end flattened, segment 14 broadly semicircular in outline and set with a quite visible fringe of hairs all along the free margin; the neck well marked, the *head* being comparatively large and triangular in shape, higher than broad with a slightly depressed dorsal line on the vertex; the colour of the head is green with a brick-brown band dividing each cheek from the face bordered inside by an equally broad yellowish band, neither of them quite reaching the vertex, the vertex itself is rather broadly brick-brown stretching down a short way onto the face and, along the inside of the yellow bands a bit further and the clypeus is outlined thinly black; the surface of the head is slightly rugose and set with microscopical hairs, some about the mouth-opening being slightly longer, the clypeus is triangular, its apex arched, acute; the mandibles are black at the ends, the cutting-edges entire, the eyes are black. *Surface* of the body is dull, transversely lined in the usual way, about six such lines to each segment, very superficially impressed. *Spiracles* small, oval, body colour, shining. *Colour* of body glaucous-green due to the darker-green ground colour showing through a grey-whitish suffusion in minute dots, each dot bearing one of the minute hairs; there is a white subspiracular, longitudinal band the whole length of the body and also three pairs of dark-green, thin, similar lines, one pair subdorsal on each side, one pair dorsolateral, one supraspiracular; ventrum and prolegs darker-green than the rest of the body. L: 25 mm.; B: 4 mm.

Pupa.—This is very similar to that of *Chapra mathias* in general *shape* and colour. It was not separately carefully recorded.

Habits.—The eggs are laid in the same place as for *Chapra mathias* and the habits of the larva and pupa are the same. The foodplants of the caterpillar are hard grasses that grow in the deserts, generally grasses of the larger sorts. The butterflies are difficult to catch as they are quick on the wing and somewhat difficult to see. They rest on the ground and on low herbage and do not rise high. Swinhoe makes two species out of this calling the other *karsana,* M. He says, however, that 'it is undoubtedly a desert form of *nostradamas.*' He says that the two are found in Burma, Western India, Sind, Baluchistan and Afghanistan, extending west into South Europe and N. Africa and north into the N. W. Himalayas and Central Asia. As the two forms are found in Sind in the exact same localities, there does not seem any good reason for separating them. He says, 'Within our limits Butler records it from Campbellpur; Attock Bridge, Kairabad, Kala Pani and Hurripur; Leslie and Evans from Chitral; we have it from Kulu' for *nostradamas* whereas, for the form *karsana,* he states that 'The types came from Rawalpindi, Punjab; we took it plentifully at Karachi, Quetta, Kandahar and in many places in Sind and in the Pisheen Valley; Nurse records it from Cutch; Doherty from Kumaon; de Rhé-Philipe from Masuri and Wood-Mason and de Nicéville record a variety from the Nicobars; these last three localities seem questionable, because it undoubtedly is a desert form of *nostradamas*'. In a series bred near Karachi all larvæ were identical but they produced both forms. Which appears to be sound enough proof.

There appears to be a species, *hainana,* M. from Hainan and another from Africa called *hottentota,* Latr. Synonyms of *nostradamas* are a fair number: *pygmœus,* Cyr. (nec F.); *pumilio,* Hoffmann; *lefebvrii,* Rambur.

It might be worth stating that *Gegenes nostradamas* has some ochreous scales above vein 12 on the upperside of the forewing along the costa as well as a small number of decumbent, short ochreous hairs in interspace 1 at the very base and a few at base of inner-marginal interspace; there is hardly a sign of hair-fringe along the inner margin. On the hindwing there is a similar paucity of decumbent hairs which occupy the part of the wing below the cell a short distance out and down to interspace 1*a* where they are most numerous. There is no sex-mark on either wing in any species known or named up to Watson's time; but he states in his paper 'A proposed classification of the *Hesperiidæ. . . .*' published in the *Proceedings of the Zoological Society of London,* January 17, 1893, that there existed in the British Museum an unidentified species from Victoria Nyanza in Africa that had one.

Subfamily (9).—NOTOCRYPTINÆ

Medium-sized butterflies that affect shady places in the jungles and, with the exception perhaps of *Hyarotis,* avoiding open spaces. They are all good fliers except, perhaps, *Sancus* that keeps to undergrowth and does not exert itself much. They are very different in appearance as may be gathered from the keys that have gone before; all are, however brown or blackish as general ground-colour. Only *Sancus* is immaculate on the upperside.

Antennæ.—More than half length of costa, reaching two-thirds in *Hyarotis*; Club gradual, long, the crook recurved at or near 90°, rather suddenly in some, the crook mostly twice as long as thickness of club, this club ending rather abruptly in *Notocrypta, Hyarotis.*

Palpi.—Second joint upturned and densely scaled; third slightly porrect, nearly hidden by hair, except in *Iambrix* where it is long and naked.

Hind tibiæ.—With two pairs of spurs; fringed with hair, although only slightly in *Sancus.*

Forewing.—Vein 12 ending on costa before end of cell. 11 free, straight; except in *Sancus* where it and 12 are bent and touch. The cell less than two-thirds costa, reaching two-thirds or nearly so in *Sancus* where the median vein is curved, making the cell longer. Discocellulars with the lower shorter than the middle, so that vein 5 is nearer to 4 than to 6; erect or suberect, slightly inwardly oblique in *Hyarotis.* Vein 3 from close to end of cell; 2 from before or after middle or from middle, variable. Costa arched, equal to the hinder margin or shorter.

Hindwing.—Vein 6 from close to end of cell; 6 also from fairly close to end; discocellulars and 5 very faint; 3 from close to lower end of cell; 2 from one-fourth to one-third before end except in *Iambrix* where it rises well before middle. Outer margin rounded.

Egg.—Limpet-shaped, a dome standing upon a narrow, sloped base. Surface shining, minutely cellular with numerous very thin and inconspicuous meridional ribs on basal band, reaching a short way up the dome. Colour from blood-red to pale-brown; or green blotched heavily with blood-red. The breadth to height about 100 to 65.

Larva.—Subcylindrical, sitting in a 'crouching' attitude when at rest, meaning pressed tightly against the surface, the head with occiput pressed back on segment 2, the mouth directed forwards; the anal segment broadly-rounded, flattened; the head triangular except in *Hyarotis* where it is semicircular in outline and really more resembles that of the baorine caterpillars; colour olive-green, naked; or whiter (*Hyarotis*) or yellowish-green (*Iambrix*); the head a red-brown or black, unmarked or white (*Hyarotis*) or greenish (*Iambrix*) with darker markins. Foodplants monocotyledonous.

Pupa.—This is the baorine type, naked, pupating more or less openly on the underside of a leaf, with a long snout and a spatulate cremaster, the proboscis prolonged beyond the ends of wings, free; of a light-green colour or old-bone colour (*Hyarotis*) or of a rusty-brown, always with a certain amount of covering in the way of white, cereous powder. There is a cushion-like spiracular expansion to spiracle of 2 in *Hyarotis* and a large, funnel-shaped one in *Iambrix*; the others having none. The pupa of *Iambrix* is abnormal, also, in being in a grass-cylinder case, quite closed.

Habits.—All the butterflies rest with their wings closed over the back; *Udaspes* has rarely been seen basking with them half-opened. None of them 'beat' in the jungles which means they don't fly backwards and forwards continually as do *Tagiades,* etc., sometimes; they sit upon the upperside of leaves low down near the ground; *Notocrypta* and *Udaspes,* more rarely *Sancus,* visit flowers and frequently, in the case of those of *Costus speciosus,* Smith, go right down the tubes; *Hyarotis, Iambrix* also visit flowers of all sorts. *Iambrix* lives much low down amongst undergrowth by the sides of clearings and paths and behave much as do *Taractrocera,* flying about over the vegetation and fighting with each other. *Sancus* is only found in very damp places in forests, often round swampy spaces and in the neighbourhood of running nallas; *Notocrypta* is not quite so particular but likes damp; *Udaspes* roves much more widely; *Iambrix* is still more careless of shade; *Hyarotis* presumably likes the sun but little is known about its habits for it is more an insect of the upper air than the others, and a much stronger flier. The eggs are always laid on the tops of leaves, one at a time and rarely more than one on a single leaf. The egg-larva makes a little tubular-oblong cell at side of leaf in the case of *Notocrypta, Udaspes* and *Sancus*; in *Hyarotis* and *Iambrix* the cell is made at the tip of the leaf by joining the edges. In maturity the first three live in a simple triangular cell made of a triangular piece turned over onto the top of the leaf and lightly fixed down by silks; *Hyarotis* places one leaf (pinna of palm) over another, lies on the upper, back downwards and fixes the pinnæ laxly together; *Iambrix* makes any sort of cell, a blade of grass on top of another or often just lies on the underside of a blade quite openly. All except the last (*Iambrix*) pupate on the underside of a leaf (or pinna) half-openly like in the *Baoris* group; the last makes a cell of a blade of grass or several blades formed into a tube closed at both ends and attached by a thin strip of edge to the petiole or stalk so that it hangs straight down, withers after a time and often drops to the ground amongst the leaf-carpet underneath.

Nothing is known, apparently, about the early stages of the insects of the genera *Acerbas, Tamela, Astictopterus, Koruthaiolos* or *Watsoniella* or 50 per cent exactly of those composing the subfamily under consideration. *Notocrypta, Udaspas* and *Sancus* show very close affinities in egg, larva and pupa as well as in habits; *Hyarotis* has a similar egg and pupa and similar method of pupation, but has a larva more resembling those of *Baoris* (also, it must be allowed, the imago is very like those of that genus in style and build) while the only character that decided the fate of *Iambrix* was the egg; that egg could not possibly be placed in any other subfamily; if it had not been for that, the genus would undoubtedly have gone into the *Erynninæ* where it may, in the end, belong—when the exiguous knowledge of the life histories of the Skippers has been largely added to by further studies. The caterpillar of *Iambrix* feeds upon grasses (*Gramineæ*), that of *Hyarotis* upon palms (*Palmeæ*) while those of the other three genera affect *Scitamineæ,* to which the Gingers belong (*Zinziber,* Adans.), *Curcuma,* L., some species of which are used locally for making an inferior saffron; *Hitchenia caulina,* Baker yields a kind of Arrowroot; the Plantain, *Musa,* L. and the Cardamum, *Elettaria Cardamomum,* Maton. well known to everyone.

Genus 32.—NOTOCRYPTA

Imago.—All the butterflies are medium-sized insects with blackish uppersides, immaculate hindwings and the forewing marked by a broad, pure-white, discal band with or without from one to three much smaller, pure-white, subapical spots. They are all shade-loving species, feeding upon flowers, resting low down with their wings closed over their backs; with a powerful flight in a jerky, up and down manner, never rising high above the ground; the flight never long maintained; with the habit of often returning to the same perch on the upper surface of a leaf in dense jungle. The Kanara species are fond of flowers of *Costus speciosus,* Smith (*Scitamineæ*) into the large-mouthed funnels of which they creep to feed when they can be easily captured. They feed in the earlier part of the mornings and evenings.

Antennæ.—More than half the length of the costa of forewing; club moderate with a short, abrupt, pointed crook that is double as long as the breadth of club and recurved at about a right angle.

Palpi.—Porrect but with a tendency upwards; second joint densely scaled, the scales fairly well appressed; third joint small, conical-blunt, nearly concealed.

Hind tibiæ.—Slightly fringed with two pairs of spurs.

Forewing.—Vein 12 ends on the costa before the end of the cell a little; 11 straight with no tendency even to approach 12; cell less than two-thirds length of costa; discocellulars suberect, the lower much shorter than the middle one; 5, therefore, well below the middle; 3 from quite close to the end of cell; 2 from before middle; costa arched slightly, the wing somewhat 'apically produced in the male' according to Swinhoe which is hardly the case; apex blunt, outer margin convex, about as long as the hinder margin; in the female the tornal angle is more broadly rounded and the hinder margin, consequently, apparently longer.

Hindwing.—Vein 6 from close to upper end of cell; discocellulars and 5 very faint; 3 from close to lower end of cell, practically from touching 4; the cell conspicuously angled at origin of 2 which arises from less than one-third before end of cell; costa and outer margin evenly rounded.

Egg.—Limpet-shaped, or dome-shaped standing on a narrow band-base with the surface smooth, there being very thin meridions on the basal band continued a short way onto the dome; the colour dark brown reddish or somewhat orange with the band transparent-glassy. Height rather more than half the breadth.

Larva.—Of the *shape* of those of the baorine subfamily but with a much smaller head and neck; the same broadly-rounded anal end, the body highest in the middle; the surface naked except for extremely minute, invisible, light, erect hairs, somewhat longer round anal margin; the skin very thin showing the tracheal, white tubes through; the head thick and triangular with the lobes very short rather sharply defined, covered with tiny, appressed, light hairs thinly, cellular-rugose, shining.

Pupa.—Of the same *shape* as those of the baorine group; with a similar snout to head and a long, slightly down-bent cremaster and very long, free proboscis that sometimes outreaches even the length of the body; quite naked except for the invisible, erect hairs; always whitish-green in colour and generally powdered over with the usual white, cereous powder exuded by the caterpillar from glands just above the bases of the legs before pupation.

Habits.—The egg is laid on the underside of the leaves; the first cell is an oblong piece from the edge turned over onto the bottom, making a cylindrical cell well coated with silk inside, fastened at one and, of course, along the inner side, open in front; later the caterpillar makes a cell by turning over a triangular piece onto the top and fixing it down lightly. Pupation takes place on the underside of a leaf of the foodplant in a channel made by drawing the surface together to form a kind of channel or hollow with a few ropes of white silk, the larva lying in the bottom of it in powder, affixing the tail (cremaster) end to a rope of silk across a pad of the same material and fastening a string over the middle of the body fixed to a small pad on each side so that the pupa lies close to the leaf-surface; the larva starts by lying with its back to the ground of course but, when changed into the pupa, this latter often squirms when touched and wriggles with the result that it is found, as often as not, with its ventrum towards the ground. The foodplants of the larvæ are always plants belonging to the family of the Gingers, *Scitamineæ* that come up plentifully in the monsoon months in the wet, damp jungles of the hills where the rainfall is heavy and the evergreen species of trees are common or predominate over the deciduous kind.

In India, China and the Malaya Peninsula and Archipelago there are twenty members of this genus, six only occurring in British India and two in China. The six Indian species are *N. basiflava,* de N.; *monteithi,* (W.-M. and de N.), the former from S. India, the other from Cachar, Borneo, Singapore and Sumatra; *albifascia,* (M.) from Burma, Tonkin, Assam, Siam, Java, Borneo; *paralysos,* (W.-M. and de N.) from the Andamans; and *feisthamelii,* (Boisd.) from India, Burma, Ceylon, Andamans, China and the Malay Peninsula. The only two species that interest these papers are *restricta* and *feisthamelii.*

233. **Notocrypta restricta,** (M.).—Male. *Upperside* black fading very little, most at base of wings. Forewing with a broad, nearly medial, pure-white, transverse band of nearly 3 mm. in width consisting of a spot filling the outer third of the cell followed below by another conjoined (even the vein being white) in interspace 2, its inner edge slightly outwardly-oblique and in a line with the inner edge of the lower half of cell-spot, its outer end reaching outwards much further than the cell-spot, its (outer) edge outwardly-oblique with a slight prominence in the middle; the third and last in interspace 1, of the same length as the cell-spot practically but connected across vein 2 (which is also white) by a somewhat narrower neck with the spot in interspace 2 above, that is the band is very slightly, sharply constricted there, this spot again narrowing very slightly from middle downwards, the inner and outer edges somewhat irregular; besides this band there are three subapical white dots in interspaces 8, 7, 6 in a nearly straight, outwardly-oblique line, another, a good deal further out (not far off submarginal), a tiny dot, in interspace 5 (may be absent), followed downwards by a somewhat larger dot in 4 and another, linear-oblique, not much larger, in interspace 3, these last three in an inwardly-oblique, straight

line. There are some decumbent, not very long, black hairs in the base of interspace 1 reaching out to origin of vein 2 and the fringe along the inner margin is slight but distinct. Hindwing : immaculate with decumbent, black, not very short hairs on the base outwards to end of cell and, below the cell increasingly further outwards to near the anal angle, densest in interspace 1*a*. *Cilia* brownish-black with still darker base ; paler from end of vein 8 on hindwing to vein 5. *Underside* paler, browner ; the outer margin of both wings again paler, sometimes somewhat greyish. Forewing as on the upperside, the apex often with blue-greyish scales at apex and rather broadly submarginally along outer margin but this may be quite wanting. Hindwing may be entirely washed over with blue-grey scales that make it quite ashy-light leaving the costa broadly and a transverse antemedial and medial narrowish band or fascia across the wing ; on the other hand there may be hardly any of the scales present.—Female exactly like the male in every way and subject to the same variations of grey wash on the undersides of wings as the male. Antennæ black with indications of pale spots at bases of the joints ; a white band round the upper end of shaft and base of club with the rest of club black except the underside of the terminal crook which is again white, the top of crook reddish-dusky. Palpi, head, thorax, abdomen concolorous with wings above ; beneath the palpi are light-ochreous ; the thorax is ashy-brown, the abdomen soiled greyish-ochreous ; the legs are light-brown. Expanse 42 mm.

The above is written from bred specimens, all from the N. Kanara District of the Bombay Presidency. Swinhoe (*Lepidoptera Indica,* vol. x) says that the expanse may be up to 50 mm. but the largest in Kanara does not exceed 42 mm.

Egg.—Limpet-*shaped,* very similar to that of *Udaspes folus,* perhaps not so broad at top ; the basal, much-inclined ring or band present here also with indications of meridional ribs running some little way onto the dome. *Surface* shining, smooth, very obscurely frosted ; the ring or band with about 48 ribs ; micropyle very minute, punctiform, in the very middle of apex ; the top very slightly flattened. *Colour* rather bright-green when first laid, blotched heavily all over the upper half with blood-red ; later on the green fades to a nondescript whitish. B : 1.15 mm. ; H : 0.7 mm.

Larva.—The *shape* is more or less fusiform with the ventrum flattened, the body highest in the middle, broadly rounded at anal end, with a very small neck in the other direction bearing a comparatively large head, although this head is small in comparison with those of the baorine group ; the body fattest in the middle and highest there, decreasing a lot to both ends ; when the larva is at rest it humps the segments 4 to 6, contracts segments 2 to 3 and lies with the hinder part of vertex of head resting on segment 2 dorsum—segment 6 is then twice the height of segment 2, it is always thrice as broad as 2 ; *head* triangular with a somewhat truncated apex, moderately and sharply triangularly emarginate in the dorsal line of vertex dividing it into two lobes each with its vertex comparatively broad ; the surface of head only slightly shining, rather coarsely cellular-rugose with many, minute hairs all over it that are hardly visible to the naked eye ; the colour of the head is dirty-whitish on the face with the whole of the back portion to the hinder margin deep-black including the gulæ, cheeks, occiput, vertex and a broad dorsal line down to apex of clypeus, then splitting down the sides of the true clypeus but including the apex of false clypeus, continuing to base thinly ; true clypeus not half the height of the face, longer than broad, triangular, apex acute ; false clypeus much longer, a thin strip somewhat bowed out in the middle, apex acute ; labrum whitish, about one-third the true clypeus in length and only very slightly transverse ; ligula whitish, as long as labrum, rather broader than long, kidney-shaped, the sinus rather over a third depth with an angle of 90°, this sinus as broad as it is deep ; antennal, basal joint whitish-glassy as is also the third ; mandibles of the block type, deep red-brown with the cutting-edges quite entire ; eyes : 1 to 4 in a slight curve, 3, 4, 6 in a straight line, 2, 3, 4 an eye-diameter distant from each other, 6 two diameters from 4, number 5 behind and two eye-diameters from 4, rather less from 6. *Surface* of larva smooth, dull, with extremely minute, erect hairs, the skin translucent-thin ; each segment with the usual, parallel six, slightly-impressed, fine, transverse lines and the base of prolegs has some folds; the true legs are small; the length of the small hairs round anal margin is 0.15 mm., those on the head are 0.05 mm.; an eye-diameter is 0.15 mm. *Colour* a neutral tint washed with a whitish, thin wash through which the neutral tint shows in minute, green spots or dots, the bases of the minute hairs; segments 2, 3 yellowish-green; segment 12 yellowish and slightly tumid at spiracles. *Spiracles* oval, slightly raised, small, white connected all along by the thin, white, tracheal lines; those of 2, 12 much larger. L: 40 mm.; B: 6 mm.; H: 6 mm.

Pupa.—Of the same *shape* as that of *Udaspes folus*; snout nearly as broad at base as head, rather long, pointed, porrect; head somewhat square, eyes not prominent, shoulders slight broader than hinder margin of segment 2; body same breadth from shoulders to 10, narrowing then to the transparent, dorsally-concave, triangular, broad, apically narrowly-rounded cremaster; front slope of 2 and thorax considerable; thorax only slightly humped, rather short, very little higher than segment 4; cremaster 3 mm. long by 2 mm. wide at front margin, occupying the whole of the dorsal aspect of 14, very thin and concave, rather the shape of a pointed gothic window, the edges thickened and obscurely knobbed at front margin, the extremity also a slight knob set with a bunch of suspensory, short-shafted hooklets; 13 = a quarter 12; 13 = one-fifth of 14; segment 11 = 2 × 12; segment 10 slightly longer than 11 and equal to 9 = 8 = 7; segment 6 slightly shorter than 7; segment 5 = half of 6 and 4 only very slightly shorter than 5; thorax = 4 + 5 + 6 together, hinder margin between a semicircle and quarter-circle curve meeting wings in a moderately shallow, moderately broadly-rounded, right-angled angle; the front margin of thorax straight, the dorsal line slightly convex, at first parallel to the longitudinal axis of the pupa, the anterior third inclined at 30° towards that axis; the shoulders evenly rounded; 2 rather longer than 5, about one-fourth of thorax, its front margin nearly straight, its dorsal line rather less steeply inclined than thorax front; head with the vertex rather longer than 2 and even less inclined, the front produced out porrectly into the long-conical beak becoming cylindrical at extremity and twice as long as 2, pointing slightly up, otherwise porrect; ventrally, at base of snout, is the semicircular clypeus; between the basal halves of proboscis is the diamond-shaped ligula about as long as twice the clypeus and nearly as broad in the middle—the clypeus is barely a couple of spiracle-lengths broad; proboscis reaches quite free beyond ends of wings and to end of cremaster and beyond even; antennæ and midlegs reach three-quarters length of wings, the forelegs about half the length of midlegs; eyes hardly prominent, the crescent linear and very straight, cutting off the posterior third of the eye-ball. *Surface* of the body shining; segments well-marked; covered with minute, erect, light hairs all over in the usual way, none longer than 0.05 mm.; and transverse-corrugate confusedly, obscurely, superficially. *Spiracles* of segment 2 oval, yellowish, slightly convex, the hinder margin of 2 just in front of them slightly thickened; the rest whitish, slightly raised, oval, each about one-eighth or one-tenth of a segment-length long and rather more than half as wide as long. *Colour* clear grass-green with a thin, white, tracheal line through spiracles; the cremaster practically transparent; a slightly-darker, dorsal line and a dorsal, black dot at front margins of segments 7 to 10; wings and snout whitish. L: 33 mm.; B: 6 mm. at middle of body; the cremaster makes up 3 mm. of the total length; B: 4 mm. at head; proboscis another 3 mm. or even longer than the whole body including cremaster, and rather stout.

Habits.—Those of the subfamily given above; the larva is sluggish at all times and feeds mostly at night. The pupa is much more energetic and, if cut loose from its moorings, the tail-fixing and body-string, it actually jumps, and rolls itself round energetically when molested. It is covered with a slight powdering of white as is the inside of the cell. The foodplant of the larva is commonly *Zinziber Cassumar,* Roxb., a wild species of Ginger growing in wet places in the Western Ghats, growing a leafing-stem of 4 to 16 feet with alternate smooth, long leaves out on each side, the fruit bright red at its foot. It has also been reared upon *Curcuma decipiens,* Dalz. and probably feeds upon others of the *Scitamineæ* or Gingers on occasion. The butterflies are fast fliers with the habits of the subfamily and are not rare in the jungles of the Western Ghats during monsoon months but not often seen during the dry season. The habitat is given by Swinhoe as India, Ceylon and Burma; he states 'The types came from Ceylon; recorded by Elwes from Sikkim; by Manders from the Shan States; by Hannyngton from Kumaon; by Evans from the Palni Hills; by Fergusson from Travancore; by Watson from Chin Hills; by de Rhé-Philipe from Masuri; we have both sexes from several Indian localities and many examples from the Khasia Hills; Elwes and Edwards, in their *Revision of the Hesperidæ,* sink it to *feisthamelii* on account of the similarity of the genitalia but Davidson, Bell and Aitken's life history is sufficient proof of the distinctness of the species.' (*Lepidoptera Indica,* vol. x, p. 201. Figures are given on plate 803 also in the book, 2 male, 2*a* female, 2*b* underside, 2*c* the larva and pupa—these last very bad).

The flight of the butterfly is by no means weak as stated in the quotation from Davidson, Bell and Aitken's paper by Swinhoe. It is powerful and fast.

234. **Notocrypta feisthamelii** (*Boisd.*).—Male. *Upperside* black. 'Forewing with a broad, postmedial, transverse, white band in a slight-outward curve, composed of three conjoined, large spots, the upper one filling the end of cell, its upper margin usually somewhat rounded, the two lower spots in interspaces 2 and 1 more or less quadrate; two or three subapical, white dots in a nearly straight line from near the costa, another in interspace 4 towards the outer margin and sometimes another inwards in interspace 3, all these dots small, varying in numbers in different examples and sometimes entirely absent. Hindwing without markings. *Cilia* of forewing brown, of hindwing paler and somewhat greyish. *Underside* paler than the upperside, the outer margins slightly suffused with grey. Forewing with a whitish mark, somewhat suffused, attached to the upper end of the discal band in continuation of it but not quite reaching the costa; the dots as on the upperside. Antennæ black, with a whitish underside to the basal half of club that goes onto the shaft and right round the whole club and shaft at that place; underside of crook also whitish. Palpi head and body concolorous with wings above and below.—Female like the male.' (Swinhoe, *Lepidoptera Indica,* vol. x, pp. 100, 200).

Swinhoe gives pictures of the insect on plate 803 depicting 1, male; 1*a* the female, 1*b* the underside and 1*c* the larva. The span of the very large female picture is 42 mm. and not 50 mm. as he says in the letterpress; the male span is 32 mm.

Now, in a series of 9 males and 9 females bred in N. Kanara District, the ordinary span is, at the most 35 mm.; never more. In all these specimens—and dozens more were bred at different times and discarded, thrown away, sent away and otherwise disposed of—every specimen has the band on the forewing as described and, in the huge majority of cases, only the outermost spot, which is always situated in interspace 4, developed, a small, elongated one; and there is rarely a sign of any other, absolutely none subapical or otherwise; in a very few examples there is a small line-spot spanning the interspace above it, interspace 5, just touching the outside of the one in 4 on the outer, upper corner. On the underside the grey markings is very similar to that of *N. restricta,* always the larger insect of the two; but it may be even more pronounced in some specimens than it is in that species. The decumbent hair of the upper surfaces of the forewing and the hindwing is similar to that in *restricta* and the inner margin of hindwing is similarly fringed with short hair. In the Kanara *feisthamelii* the white, discal band of forewing is rather narrower and has always more regular edges than that of *restricta.* The insect is really more like the pictures of *N. paralysos* from the Andamans except that there is never a spot in cell and another below it on underside of hindwing.

Egg.—This somewhat the *shape* of a limpet, somewhat like that of the Silver-spotted Skipper (*Erynnis comma*) at home but it rests on a narrow inclined band or base; it is dome-shaped, the dome resting on a very thin, inclined band-base, the top of the dome very slightly depressed. *Surface* shining, slightly and obscurely frosted looking with an indication of very thin meridional ribs upon the narrow basal band, continued very shortly up onto the dome; the base is practically transparent-glassy. *Colour* rather light brownish-orange. B : 0.8 mm.; H : 0.5 mm.

Larva.—This is of the same *shape* as that of *Udaspes,* similar to that of *Baoris farri* in a manner but with the head very much smaller than in this last species, triangular in shape instead of semicircular and thick, the neck being of course also thinner in proportion to the body for the head is large compared to the neck as is the case in all skipper larvæ; the anal segment is flattened and broadly-rounded at extremity, outreaching the short claspers by a good deal; the ventrum is flattened, the middle of body is the highest point, the prolegs and true legs are short; *head* obcordate, that is heart-shaped, the vertex being narrowest and sharply, triangularly, very narrowly indented in the dorsal line dividing it into two lobes with the vertex of each narrowly-rounded, the surface shining cellular-rugose, with extremely minute, light, appressed hairs and some longer ones about mouth-opening; the colour of the head is very dark reddish-brown including the mandibles; the true clypeus is long-triangular, the false clypeus with the sides somewhat out-curved, the apex acute, reaching three-quarters the height of head while the true clypeus reaches half the height of head; the labrum is transversely oblong, short; ligula rather longer than labrum, longly kidney-shaped with the sinus about one-third the depth, triangular, the angle about 90°; eyes concolorous with face. *Surface* of body hardly shining, and smooth except for extremely minute, hardly visible hairs, erect all over the body, longer and just visible round free margin of segment 14 and on leg-bases; there are also the usual impressed, thin, superficial, transverse, six lines parallel to the segment-margins on every segment except 13, 14 and 2, segment 2 whitish-green with a somewhat whiter, shining-chitinized collar. *Spiracles* white, small, rather broadly-oval, flush, those of segment 2, 12 twice the size of the rest. *Colour* a washy, rather light, olive-green all over, the neck of segment 2 whitish, the ventrum lighter than above; in one larva there were two oval, yellow bodies dorsally immediately behind front margin of segment 10, one on each side of dorsal line (the testes?) and side by side, one slightly in advance of the other, subcutaneous, that sway towards and away from each other mostly, each about one-third the length of the segments and about two-thirds as wide as long; the skin is very thin and all the little, thin, tracheal, white tubes show plainly through it. When about to pupate the larva develops a white, cereous patch of powder between and just above the legs on segments 3, 4. L : 31 mm.; B : 4 mm.; head 2 mm. wide and the neck much less; anal segment at front margin 2.5 mm. wide.

Pupa.—This is exactly the same in *shape* as the pupa of *Notocrypta restricta,* (M.); so similar indeed as to need no separate description. L : 25 mm.; B : 5 mm.

Both these species of *Notocrypta* (*restricta* and *feisthamelii*) were bred in the year 1891 in the N. Kanara District; the one at a place called Dandeli on the Kalinaddi River above the Ghats, the other at Potoli not very far away. The difference in the larvæ was noted in a very short time and has never since, in all these thirty years during which caterpillars have been collected and bred out, been doubted as an absolutely reliable way of distinguishing the two species and has never led to a single disappointment. Why the two species have been ever confused it is difficult to say for, as may be gathered from what has gone before above, the bred butterflies are easily distinguished in Kanara. It may possibly be that, elsewhere, *restricta* may occasionally want some of the apical spots, or a few of the discal small ones; and that *feisthamelii* may possibly, develop an apical dot or two which it never has in Kanara. Swinhoe *says* that this latter species has three subapical dots which, however, in the picture on the plate, are absolutely wanting in the male though just indicated by two obscure ones in the female (this looks extraordinarily like *restricta* from the size). Altogether it is difficult to get away from a strong suspicion that the two species have constantly been mixed up in collections in the past and probably are so still. Elwes and Edwards (already mentioned under *restricta* above) considered them one because the genitalia did not differ.

Habits.—These do not differ in any way from those of *N. restricta* except that, perhaps, the imago is not quite such a strong flier as that of *restricta*. Both species are found above 1,000′ in the Western Ghats but not below that height. They are both, of course, altogether insects of the forests and hills and heavy rainfall, never entering the plains, by which is meant open spaces of large extent that are bare of forest and have a rainfall too low to grow the foodplants of the caterpillars.

Genus 33.—SANCUS

Imago.—This is a peculiar insect that sits with its wings upright over the back but each wing, or, at least, the forewing, is always very slightly concave on the underside so that the tips never meet; it is fond of shade, frequents ground. The wings are uniformly very dark-brown, nearly black above, slightly flowers busily, flies weakly and never rises much above the surface of the lighter below and the male has a sex-mark on the forewing. There are three species known from the Malay Archipelago, two of them from Celebes Islands; only one, a fourth, exists in British India.

Antennæ.—A little more than half the length of costa of forewing; club elongate, gradually wide-curved and acuminate.

Palpi.—Suberect; second joint densely scaled but the scales long and laxly parted at the ends; third joint concealed.

Hind tibiæ.—Nearly naked and with two pairs of spurs.

Forewing.—Vein 12 ends on the costa before end of cell; 11 curves upwards shortly after its origin (and 12 down towards it) to touch 12, then separating from it again; cell about two-thirds the length of costa; discocellulars erect, the middle slightly longer than lower; 5 from below middle, median vein curved making the cell somewhat broad; 3 from about one-fifth before lower end; 2 from about the middle; costa highly arched; apex subacute; outer margin convex, oblique, shorter than hinder; the wing long for its breadth; the male with a curious, furred-looking, somewhat-impressed, rather large, oval sex-mark with its upperside touching the median vein and extending from near the middle of the cell to beyond the origin of vein 2 which it touches.

Hindwing.—Vein 7 from close before upper end of cell; discocellulars faint; 5 very weak; 3 from a little before lower end of cell; 2 from one-third before end; wing rounded.

Egg, larva, pupa, habits.—Only known for the single species described below—

235. Sancus subfasciatus (M.).—Male and Female. *Upperside* : uniform dark vinous-brown, nearly black when quite fresh. Forewing with no hair at base, nor a fringe along the inner margin. Hindwing with practically no hair on the surface. *Underside* paler brown with a pale spot in each of the interspaces 4 to 9, those in 4, 5 beyond the middle of interspace, those in 6, 7 at middle and base respectively, those in 8, 9 at middle end respectively of their interspaces, these last four subapical, the first two discal, the upper of these latter the further out and in continuation of these last two a white-flushed smudge runs to the apex on the forewing. Hindwing with two pale, transverse fasciæ, the one discal, the other submarginal, broad, the submarginal one bordered on the inside by small lines, one in each interspace, of ochreous scales against the dark of the ground colour ; and there is a similar short line or band of similar ochreous scales in the upper half of cell towards its end and one across the middle of interspace 7 as well as a spot towards base of interspace 6—all these ochreous scale-spots may be very obscure in specimens that are any way worn ; finally the inner margin of forewing below the median vein is much paler than the rest ; on the hindwing the abdominal margin, that is the whole of interspace 1*a*, the margin itself and the outer bit of interspace 1*b* is also pale. *Cilia* uniform dark-brown becoming slightly pale at anal angle of hindwing. Antennæ black, the underside of shaft spotted ochreous, the club ochreous beneath with the tip very dull reddish-brown. Palpi, head, thorax and abdomen concolorous with wings, the palpi having a few ochreous hairs ; legs somewhat paler brown. Expanse up to 35 mm. for Kanara specimens, the female always being somewhat larger than the male. Swinhoe gives up to 45 mm. but his figures on the plate 789 of *Lepidoptera Indica,* vol. x, do not measure more than 37 mm.

Egg.—This has not been particularly noted but is not likely to differ much from that of *Udaspes, Notocrypta.*

Larva.—This is very similar to that of *Notocrypta* in *shape* : it is fat and spindle-shaped with the greatest diameter in the middle, the ventrum flat, the claspers and prolegs short, the true legs similarly short, the feet of the prolegs are circular and clasp longitudinally, having the appearance ventrally of a very long, thin oval of hooklets from the outside, regarded laterally, they appear to be one-lobed ; the anal end is broadly rounded, somewhat thickened round the margin ; the neck is very thin compared to the middle of the body and the head is large compared to it but, even then, small for the diameter of body even at segment 3, let alone in the middle ; this *head* is heart-shaped, the sinus on vertex moderately deep, narrowly triangular dividing the head into two lobes with rather narrowly-rounded vertex to each, the face is convex, the surface cellular-rugose, slightly shining with tiny appressed hairs and some rather longer about mouth-opening ; the colour of the head is chocolate-brown all over ; segment 2 is whitish or yellowish and has a shining chitinized collar ; the usual transverse six depressed, thin lines or folds are present on the hinder half of segments 4 to 11 ; when resting the larva humps the body in segments 4, 5, contracting the head and 2, 3 a good deal, the head then lying with the mouth well stretched forwards, the vertex lying back on segment 2, 3. *Surface* naked to the eye, smooth ; segments quite well defined, the skin thin showing the tracheal lines through ; the whole covered with the minutest of erect, whitish hairs only visible under a lens, those on anal margin a little longer. *Spiracles* somewhat prominent, oval, situated on slight tumidities of the body, yellow in colour. *Colour* a translucent bluish-green of an olive shade with segment 2 yellowish and a yellow shade on 3, 4, 5 when contracted. L : 35 mm. ; B : 5 mm.

Pupa.—Of exactly the same *shape* as that of *Notocrypta* and very similar in every way to it ; body cylindrical in shape from shoulders to 13, decreasing in diameter from middle ; head and 2 quadrate more or less in outline, the dorsal line inclined slightly to longitudinal axis of body, the frons of head produced into a 1.5 mm.-long beak or snout not as broad as head at base with the distal half cylindrical ; thorax very slightly humped or convex ; hardly any dorsal constriction at segment 5 ; abdomen from end of wings to end of cremaster is exactly half the length of the whole body, the cremaster triangular in outline, thin, long, the extremity narrowly-rounded, curved down somewhat ; proboscis free from ends of wings and reaching to extremity of cremaster ; eyes not prominent; shoulders evenly-rounded. *Surface* of body smooth, shining, naked except that, under a strong lens, it is covered sparsely with tiny, erect, light hairs; segments quite distinct. *Spiracles* small, prominent, oval, white. *Colour* green with the wings whitish, the cremaster nearly transparent, whitish. L: 33 mm. over all; snout 1.5 mm.; cremaster nearly 3 mm.; B: 6 mm.

Habits.—'The egg-larva makes the usual little cylindrical cell by turning over an oblong bit of leaf from the edge. Later on the caterpillar turns over a triangular bit from the edge onto the bottom or top, fixing the edges down laxly with a few silks and lies humped up inside, always straight, never with the head back on the side; it does not clothe the inside with silk or does so very little. Wanders eventually, when full grown and changes to a pupa on the underside of a leaf in a hollow or channel, quite open, with the back to the ground, in the orthodox manner for this subfamily. The larval cells are conspicuous in the jungle when made on the upperside of leaves because the underside of the foodplant leaf is pale, (*Phrynium spicatum,* Roxburgh) the upperside very much darker and all the plants are only a foot at most over the surface of the ground, each leaf single on a long, thin stalk. The plant grows gregariously, plentifully, luxuriously in very damp places in the evergreen jungles of the Western Ghats during the rains but dies down completely when the monsoon is over except in swampy ground. The pupa will lie over this off-season when there is no food for the caterpillar as, in cages, bred in a bungalow, this happens constantly with pupa of the subfamily. They lie for months without producing butterflies. There is generally a little white powder on the pupa but never much. The butterflies are quite plentiful in the monsoon months in Kanara where the foodplants grow and is a weak-winged insect, keeping much to the underwood where it sits on the tops of leaves with the wings closed over the back, their tips (the forewings) always appearing to be damaged because they bend strongly outwards and never quite meet. During the dry season very few are ever seen. Swinhoe gives the habitat as Burma, Assam and S. India; saying 'The types are from Tenasserim; de Nicéville records it from Sibsaghor in Upper Assam, Akyab, Rangoon and the Donat Range, Elwes from the Karen Hills; Watson from the Chin Hills; Ferguson from Travancore; it is in our collection from Rangoon, Silchar in Cachar, Sibsaghor, Karwar where Davidson, Bell and Aitken bred it; and we have received many examples from the Khasia Hills; it is very like *A. pulligo, Mabille* from the Malay Archipelago but that species is more uniformly coloured above and below and, apparently, never has any indication of spots or fasciae on the underside. Our figures of the larva and pupa are from Davidson's original drawings.' (Swinhoe in *Lepidoptera Indica,* vol. x, p. 138; the figures are on plate 789, No. 1 male, 1*a* female, 1*b* underside, 1*c* larva and pupa which are rather like sausages).

The foodplant in Kanara, *Phrynium,* belongs to the *Scitamineœ* which contains the Gingers. It is more than probable that the larva may feed upon other plants of the family as well but it has never been found on any other as far as is known.

Sancus contains three other species besides the above one; but they are found in the Malay Archipelago and never in British India if *S. pulligo* is, indeed, a different species to the above one.

Genus 34.—UDASPES

Imago.—See below. There is but one species, a medium-sized skipper of a black colour with large white markings on both wings; of strong flight, keeping much near the ground, feeding freely at flowers, sitting with the wings closed over the back, fond of shade and to be located generally amongst the Gingers that grow up in forests of heavy rainfall at the beginning of the monsoon; it lays eggs upon those plants whose flowers come up from the bare ground after the very first showers, thick little spikes of large, lipped flowers that are generally white with yellow throats (may be yellow or even pink or brown-red) which, when looked into, show a curious little cow's head, very perfectly shaped with short, sharp, curved horns—these are flowers of *Curcuma* of various species, a sort of Wild Turmeric.

Antennæ.—More than half the length of the costa of forewing; club moderate, with a pointed crook that is at least double as long as the width of club.

Palpi.—Porrect; second joint inclining a little upwards, densely scaled; third joint minute, bluntly-conical.

Hind tibiæ.—Fringed moderately lightly and with two pairs of spurs.

Forewing.—Vein 12 reaches costa before end of cell; cell long, but less than two-thirds costa; vein 11 quite straight, quite free; discocellulars suberect, the lower considerably the shorter; 5 therefore much nearer 4 than to 6; vein 3 from close to lower end of cell; 2 from about one-third from base; costa fairly well-arched; outer margin evenly rounded, shorter than the inner margin.

Hindwing.—Vein 7 emitted close to upper end of cell; discocellulars and vein 5 very faint; 3 from close to lower end; 2 from one-fourth before end; lower margin of cell slightly angled at origin of vein 2; costa and outer margin evenly rounded.

Egg, larva, pupa, habits.—See below.

236. Udaspes folus, (*Cramer*).—(Pl. M, figs. 78 male, 78*a* female).—Male *Upperside* black, the basal portion of both wings covered with minute yellowish scales; markings pure-white, semihyaline. Forewing with a large, white spot filling up the end of cell but not quite reaching that end; two similar, conjoined spots outwardly in interspaces 1, 2, below it, extending from vein 3 to vein 1, sometimes linearly separated by vein 2; four conjugated subapical spots, the uppermost minute or wanting, in interspaces 9, 8, 7, 6, the lowest the longest; and two similar to them further out and below them in interspaces 4, 5 with, finally, another, somewhat linear, spanning interspace 3 between the last and the large discal one of interspace 2 beyond it and well separated on both sides from the others. Some ochreous scales at base above vein 12 on the costa; some decumbent, grey hairs below the cell in interspace 1 from base of wing outwards and very few more below vein 1 at base; there is a slight fringe of blackish hairs along inner margin. Hindwing with a large, medial, white patch from vein 7 to 2, its margin sinuous all round; some short, decumbent, blackish hairs above vein 6 on basal half of wing and some longer, decumbent, grey hairs in base of cell and beneath it reaching out to end of white patch and thence to near anal angle, densest in interspace 1*a*. *Underside* paler with a chocolate shade. Forewing with the markings as on upperside and a grey-scaled fascia from costa near apex down to vein 3 making a submarginal band. Hindwing with the white, medial patch extending to base of wing and abdominal margin as a densely grey-scaled area leaving a chocolate short band across interspaces 1*b* and 2 near the base of 2 and about the middle of 1*b*; only the costa from cell and vein 6 upwards is black-chocolate except for the spur from middle of the white patch; all the rest is white and grey; the white patch has elongate, reddish scales on it often below vein 6. *Cilia* blackish alternating with white spaces between the veins, the apex and anal angle of hindwing without black interspaces. Antennæ black, the shaft ringed white beneath; the club with the basal half and upper part of shaft white all round, the crook white below, dull-red above. Palpi, head and body concolorous with wings above; below whitish; the legs ochreous beneath, brown above.—Female like the male in every way and only to be distinguished by the slightly more convex outer margin to forewing and by the end of the body where the genital openings are situated. Expanse up to 45 mm.

In the dry season the reddish scales on the white spot on the underside of hindwing are nearly always present, in the rains these may be entirely wanting; the chocolate shade is also most strong in dry weather specimens.

Egg.—This is in the *shape* of a dome, depressed, the height being a good deal less than half the width; standing on a very narrow inclined band of about 0.05 mm. that slopes outwards. *Surface* shining, obsoletely, minutely cellular under a high-power lens from the base up to near summit which is somewhat flattened; immediately round the apical micropyle the surface is quite smooth and sprinkled with very minute, sparse, pointed tubercles; the basal band or foundation is very regularly, longitudinally 48-ribbed with ribs that run up for a short distance onto the dome. *Colour* blood-red, the rim glassy-transparent, the ribs whitish. B: 1.3 mm. without basal rim, 1.4 mm. with it: H: 0.5 mm. or even a shade less.

Larva.—This is of exactly the same style and *shape* as those of *Notocrypta, Sancus*; that is it is fat, highest in the middle as well as broadest, the ventrum flattened, the prolegs and claspers and true legs short; the anal end flattened and broadly semicircular sloping up dorsally from the very slightly thickened free margin to 13 and 12; the neck is very much narrower than the anal end, the *head* broad and high in comparison to it although small for the body as is usual in the subfamily; when hunched up, as the larva is when at rest, the body is highest at segment 5 and even broadest there then; segment 3 very much shortened, 2 drawn into it slightly, the head with its vertex laid back on 2 and 3, the mouth stretched out, the face directed upwards; *head* triangular, somewhere about 3 mm. broad by 4 mm. in height, narrowly bilobed, the lobes rather narrowly-rounded on vertex with the face convex somewhat, the surface coarsely cellular-rugose and covered with the minutest of hairs that are hardly visible even under a lens although there are some about the mouth-opening that are longer and quite easily seen; the colour of the head is black, somewhat shining; the true clypeus is less than half the height of the head, triangular, nearly equilateral, the apex acute; the false clypeus also with acute apex, reaching a bit higher up, the sides somewhat curved out, width narrow; labrum very slightly curved with the concavity of the curve forwards, transverse-oblong, one-third as long as true clypeus, the same colour as face, the frontal curve filled up with membranous tissue, three times as broad as long; ligula very slightly longer than labrum and as broad as labrum, broadly kidney-shaped, the frontal sinus one-third depth, rounded one-third width of the whole, the lobes broadly rounded on each side of it; antennal joints whitish-green; mandibles strong, the colour of head, the cutting-edges entire; the eyes are arranged with 1 to 4 equispaced and equal in size, separated by an eye-diameter from each other, 1, 2 practically at right angles to 2, 3; numbers 3, 4, 6 in a straight line, 4 quite two diameters from 6, number 5 behind making a perfectly equilateral triangle with 4 and 6. *Surface* of the larva with segment 2 with a yellowish-chitinized collar; segments all well defined, shining and with the transverse, impressed, superficial, thin six lines as usual to each; also covered with the minutest of erect, light hairs only visible under a lens, those round the free margin of anal segment longer and visible; the skin very thin, showing the tracheal tubes through. *Spiracles* small, whitish, oval, slightly prominent situated on very slight swellings. *Colour* a translucent-looking kind of olive-tinted green with a dark, pulsating, dorsal line; anal segment whitish with segments 2, 3 yellowish as well as the margins of 4, 5 when the body is at rest. L: 37 mm. at rest; over 40 mm. otherwise; B: slightly over 6 mm. at middle.

Pupa.—Exactly in shape as that of *Baoris farri* depicted on plate II, Fig. 3*a* accompanying these papers. That it is the same as those of the baorines in general and of *Notocrypta* or *Sancus.* Shape cylindrical from evenly-rounded shoulders to end of wings, then becoming conical to end of 13, this cone being nearly half the length of the whole; the head more or less quadrate, the shoulders a bit rather suddenly broader; the cremaster a longish, triangular, thin piece, narrowly rounded at extremity, hollowed out dorsally leaving a rather narrow edge on each side that becomes still narrower backwards, the bunch of short suspensory hooklets at the extremity; *head* with the vertex prolonged into a snout; conical at base, cylindrical in distal half and bluntly pointed; the clypeus ventral at base of snout, triangular, the ligula diamond-shaped, smaller, beyond between the basal halves of proboscis; the proboscis prolonged free to end of cremaster, midlegs and antennæ reaching just beyond middle of the wings, the former slightly the longer, the forelegs hardly reaching half the length of wings; eyes not prominent with the crescent linear a little behind the middle of eye-ball. *Surface* of pupa very superficially transversely-wrinkeld, the snout rather more coarsely; shining; segments well-marked; covered with the minutest hairs that are only just visible under a lens. *Spiracles* of segment 2 represented by a light-yellow, slightly-convex, broadly-oval surface on the front margin of thorax; this oval is as long as the adjacent antenna is broad; other spiracles oval, about as long as one-eighth a segment-length, slightly-prominent, thin discs, rather broader than one half their own length, with a central-longitudinal slit; light-yellow or nearly white. *Colour* a translucent, bright grass-green, with the wings lighter; shining and with the cremaster transparent-whitish. L: 33 mm.; B: 6 mm. or less.

Habits.—The eggs are laid on the undersides of leaves in the shade. The little larva makes a cell by turning over a trianguar bit from the edge onto the under-surface and fastening it down lightly but making very little lining. This method goes on to the end. The larva is sluggish, lies full-length in the cell all day but hunched somewhat as described; comes out to feed at night and in the evening and morning. Pupation takes place in a fold on the underside as is characteristic of the subfamily; the pupa lying exposed, covered with a slight white powder exuded from the larval body before turning into the chrysalis. In the dry season this pupa may lie over for some months before giving birth to the butterfly. Some that changed in October did not bring forth butterflies until March of the next year. The foodplant of the larva is ordinarily *Curcuma decipiens,* Dalz. in Kanara but it has been found on various other *Scitamineæ occasionally.* The butterfly is a fast flier, feeding greedily at flowers at times; it keeps close to the ground over the herbage and settles with the wings closed over the back on the top of a leaf or on the underside. It basks with them half open however, in a patch of sunlight, on occasions. It never flies for any length of time at a stretch and never rises any great height. The insect is found in India, Ceylon, Burma, China, the Malay Peninsula, Java, Siam, Sambawa and Bali. 'A very common species recorded from many localities within our limits. The larva and pupa are from Davidson's original drawings not previously published.' (*Lepidoptera Indica,* vol. x, p. 207. Plate 805 of the book showed figure 1, a male; 1*a*, a female; 1*b* an underside and 1*c* the larva and pupa).

The figures of the male, 78 and of the female 78*a* on the coloured plate M accompanying these papers are too pink, otherwise very good and both show, on the underside of the hindwings, a detached white spot in interspace 6 middle that sometimes exists, not mentioned in the description above.

Genus 35.—HYAROTIS

Imago.—A single species with an upperside marked something like a *Baoris* on the forewing and, like one also, with the hindwing immaculate; a fast flier frequenting the hills and jungles in the opener situations where palms grow; the larva feeding upon *Phoenix* or Date Palm.

Antennæ.—Long, more than two-thirds the length of costa of forewing; club slender, elongate with a short, curved crook and pointed tip bent at a right-angle and more than twice as long as the width of the club.

Palpi.—Obliquely erect; second joint densely scaled, the third minute.

Hind tibiæ.—Fringed with long hair and with two pairs of spurs.

Forewing.—Vein 12 ends on the costa before end of cell; cell less than two-thirds length of costa; discocellulars inwardly oblique, the middle one the longer; 5 from below the middle; 3 from close to lower end of cell; 2 from before the middle; costa gently, evenly arched, apex produced, more in the male than in the female; outer margin very slightly convex in male, more rounded in the female; outer and hinder margins about equal in length.

Hindwing.—Vein 7 emitted about one-fourth before upper end of cell; discocellulars faint and concave; 5 not traceable; 3 from very close to lower end of cell; 2 from about one-third before end; wing rather longer than broad in the male, more rounded in the female; outer margin even. No sexual characters in the male.

Egg, larva, pupa, habits.—See below, there being only the one species.

237. **Hyarotis adrastus,** (*Cramer*).—Male.—*Upperside* dark olive-brown that is nearly black, with semihyaline, white spots on the forewing. Forewing with three subapical dots in interspaces 6, 7, 8 in an outwardly-oblique curve; a subquadrate spot constricted at its middle, sometimes not, crossing the end of cell but not reaching the end with another below it in interspace 2 of about the same size, half of it moved out beyond the outer margin of the cell spot; a small dot outside them near the base of interspace 3 and another just touching the upper edge of vein 1 a little after the middle of the interspace 1. Hindwing immaculate. There is very little decumbent hair on base of forewing and hardly any fringe to inner margin; on hindwing the decumbent hair below cell in interspaces 1*a*, 1*b* rather sparser than is usual. *Underside* with the base black-chocolate. Forewing with this dark base continued out to the discal band of white spots and beyond in interspaces 2, 3 and thence upwards as a submarginal band narrowing upwards and breaking into spots 6, 7 to apex; the discal band of white is continued to costa as a white suffusion that stretches outwards to the submarginal dark spots just mentioned (and slightly, beyond to very apex) and downwards into the end of cell and interspaces 4, 5 leaving the subapical spots dark-bordered, somewhat suffusedly so inwards; as a matter of fact all the white marking is bordered thinly dark; there is large suffused-white spot above vein 1 below the end of the discal band but disconnected from it. Hindwing with the dark base only extending to a third of the length of wing, there bordered by a transverse band of pure-white from costa to vein 1*b* consisting of a spot filling the end of the cell, transversely elongate, straight on the inner margin and emarginate-curved on the outer margin with a similar spot in interspace 1*b* connected with it by a very small, similar one in the very base of interspace 2, above the continuation to costa is wanting in the base of interspace 6 which is, however, suffused with white scales instead but present between veins 6, 7 in interspace 7 as another inwardly straight-edged, outwardly emarginate white spot which is again continued to costa by white suffusion; the white spot of this transverse, white band in interspace 6 is dislocated right out to just beyond the outer edge of spot in 7; this band is edged dark-brown on the outer side thinly followed by a rather broader, transverse band of the white suffusion that is again edged thinly brown beyond which the wing is brownish-white with a more semicircular outwardly-curved fascia of dark-brown that might be called submarginal from interspace 1*b* to costa before apex. Antennæ black above, the shaft greyish beneath, the top end of club with a white, wide band right round it, the crook dull-red. Palpi below ochreous becoming darker upwards because mixed with brown hairs; pectus ochreous much mixed with similar hairs: legs brown-ochreous. Head and body concolorous with wings above; beneath greyish-ochreous.—Female. slightly paler than the male; the spots decidedly larger; otherwise nearly exactly similar. Expanse up to 42 mm.

Swinhoe gives 52 mm. as the expanse of the female which he says is 'usually much larger' than the male (*Lepidoptera Indcia,* vol. x, p. 170. The insect is figured on plate 796 of the book, 3 representing the male, 3*a* the female and 3*b* the underside). The measurement of the pictured female is 42 mm. and, therefore, does not agree with the text statement. In N. Kanara where many individuals have been bred the largest female measures 42 mm. in expanse; the males somewhat less, though not very much.

Egg.—The *shape* of a very high dome, widest at base because standing upon a narrow, sloping flange or foundation. *Surface* moderately shining, satiny-looking and frosted; sculptured with 32 extremely fine, meridional ribs that extend from, and including, the base to about two-thirds of the way to apex; the upper third remaining quite smooth-frosted. *Colour* a light, rather soiled brown. B: 1.4 mm.; H: 1 mm.

Larva.—Is the same *shape* as those of *Baoris farri,* etc.; the body is long-stretched and parallel-sided, flattened on ventrum, convex transversely over dorsum, narrowing to head in segments 3, 2; segment 12 somewhat tumid laterally in the spiracular region; segment 13 less than half of 12 in length, longer dorsally than spiracularly; 14 very slightly narrower at front margin than 13 at hinder margin—the margin slightly constricted that is—and broadly more or less semicircularly rounded (slightly longer), the free margin or end slightly overreaching the anal claspers and lying practically close against the resting-surface because the claspers are so short as are also the prolegs and true legs; *head* rather large, semicircular-elliptical in shape, the vertex with a very slight sinus dividing the lobes which are consequently very broad, the face convex, the surface rather cellular-rugose and covered with the tiniest of semidecumbent, light, fine hairs with some longer ones about the mouth-opening as usual; the colour of the head is very light, somewhat soiled whitish-yellow with a narrow black hinder margin widening into, often, a broad black band onto the cheeks that does not include the eyes, with a broad dorsal band over vertex to clypeus-apex that may often include the false and true clypeus and, sometimes, there even may be an extra, black or brown band from middle of clypeus side running upwards parallel to the dorsal one to beyond the apex of clypeus; in some specimens there is hardly any marking at all except the narrow line along hinder margin by neck and a bit of the dorsal band down face; true clypeus triangular with an acute apex, reaching middle of face, often outlined thinly blackish-brown, it and the false clypeus together twice as long as the width at base, the false clypeus reaching beyond middle of face with the sides slightly bowed out, the apex acute; labrum as long as, rather more than one-third of the true clypeus and twice as broad as long, the hinder margin straight, the front strongly curved-emarginate, the emargination filled with membraneous tissue; ligula as long as labrum, somewhat longly, semicircularly kidney-shaped, the sinus rather broader than the somewhat incurved lateral lobes, rounded and only about a third the depth of the whole organ; antennal, basal joint whitish, third stained light-rusty; mandibles of the block type, shining-rusty, with the ends narrowly black, the cutting-edges quite entire; the eyes arranged: 2 to 6 in a straight line with 1 behind and at right angles to 2 or very nearly so, 1 to 4 about one eye-diameter one from the other, 6 very close on five eye-diameters from 4, number 5 behind and nearly four diameters from 4 and two from 6. *Surface* of body is dull, smooth, covered all over with minute, short, erect, light hairs that are hardly visible, with much longer ones round the somewhat thickened free margin of anal segment which are quite as long as a spiracle and very visible and consist of a fringe of about twenty strongish ones with a supplementary fringe of shorter, weaker ones below them; there is a small, central, dorsolateral, circular, disc-like lenticed on 7 to 11, segments all well marked with the usual six impressed, parallel, transverse lines parallel to hinder margin of each segment. *Spiracles* broadly oval, moderately large, one-twelfth of a segment long, light yellow, more or less convex, brown border; those of 2, 12 much larger than the rest. *Colour* a chalky-looking bluish-white all over, the segment-margins showing dark; a broad, darkish-green, dorsal line not reaching the anal flap nor segment 2; vestiges of a whiter and narrower, subdorsal and dorsolateral band as well as a spiracular, white line; on the anal segment the dorsolateral band is always somewhat conspicuous though not very prominent. Before the larva pupates it becomes pinkish translucent-white with a broad dorsal line of dark-brown specks reaching to the very end of 14 as a brown line not existing on segment 2; also there is then a dorsolateral, brown band of speckling most intense in the middle of each segment and a similar, somewhat narrower, lateral band. L : 33 mm. ; B : 4 mm. but the larva was a small one. Head : 3 mm. in diameter.

Pupa.—Similar to that of *Baoris farri* in *shape* with similar long snout to head and spatulate cremaster, the pupa fixed in the same way by tail and body-band in a longitudinally half-open cell made on the underside of a leaf; the head-piece, consisting of head and 2, is square, the frons or front being prolonged into a conical, long snout about 3 mm. in length, its base occupying the breadth between the eyes to quickly thin from an original 2.25 mm. to 1 mm. diameter; the clypeus is on the proximal, ventral side of this snout; dorsal line of snout together with vertex of head is extremely little inclined to longitudinal axis of body: segment 2 and anterior moiety of thorax are inclined in the same line at about 30° to that axis; 2=rather more than one-quarter length of thorax or about length of head-vertex or about 4+half of 5; head-vertex+snout rather longer than thorax; thorax=4+5+6; segment 4=5 and 6=4+5; thorax with dorsal line parallel to axis in posterior third, in even continuation with 4 and 5, the hinder margin a short, wide parabolic curve meeting the wings in a very widely-rounded, somewhat-entrant angle of 70° or so and the shoulders are evenly rounded and very sloping; 7 a bit longer than 6 and 8 than 6 with 9 about equal to 10; segment 11 a bit shorter than 10 and very nearly equal to 12 which is, perhaps a bit shorter than 11; segment 19 about one-third of 12, not very conspicuous; 14 consists altogether of the spatulate cremaster which equals 12+13 together and is nearly twice as long as its base (front margin) is broad with rather-broad, very slightly raised, superficially corrugated extensor ridges bordering the smooth, hardly-depressed, central-dorsal space; ventrally the cremaster is hollowed out somewhat with strong-prominent extensor ridges bordering the hollowing and continued to meet in front of anal-clasper scars in a curve; the suspensory hooklets are bunched ventrally at extreme point of cremaster and are very short and fairly numerous. *Head* with the front of eyes somewhat prominent making the squareness of head, the crescent a broad, smooth band with front and hinder margins depressed lines, anterior margin slightly postmedial; clypeus triangular, proximal side convex fronted, point formed by the encroaching eye-covers that come into contact, broadly-rounded, in front of it leaving a small, triangular piece which may be the base of palpi, just before proboscis commences; proboscis in a female reached to hinder margin of 11, being free after end of wings; midlegs and antennæ reach two-thirds length of wings, the antennæ very slightly shorter than midlegs; forelegs reach well beyond one-third length of wings; there is no coxal piece. *Surface* slightly shining, nearly quite smooth, perfectly naked; slight wrinkles following contours of spiracles of 6 and 7; dorsal line of thorax with a line of slight tooth-like roughness, for about one-third its length in middle, down each side of actual line. *Spiracles* of 2 large, disc-like, slightly-raised, more or less semicircular-oval, cushion-like, as broad as half length of segment 2 and half as long as broad, light-yellow, about five times as long as one of the other spiracles, situated on front of thorax at margin; others about one-seventh of segment 6, oval, disc-like light-yellow, whitish, over twice as long as broad. *Colour* that of a dead bone with a very slight pinkish shade from 4 to 11 dorsally; a subdorsal, broad, irregularly-bordered, black-speckled, greyish band with quadrate extension out sideways behind middle of each of segment to just above imaginary-lateral line of body, this band from front margin of 2 to 12, the extension of hinder part of thorax ink-like, much blacker than on other segments; ventrum practically without any marking, dorsum with sparse, freckle-coloured dots besides, snout often with a few black spots, transversely corrugated. L : 35 mm. ; B : 5.5 mm. ; the snout 5 mm. and cremaster nearly 3 mm. of the length; H at thorax : 4.75 mm. ; at 9 : 4 mm.

The snout in the pupa contains only the frontal tufts of heads of imago and is otherwise hollow as is easily observed just before the butterfly emerges. The proboscis often reaches front margin of 14, irrespective of sex; the antennæ also are very slightly variable in length, sometimes reaching as far as midlegs also irrespective of sex.

Habits.—The egg is laid, always single, on the underside of a leaf, sometimes on the upperside. The young larva, emerging, makes a semitube from the point of the leaf by joining the edges with silken threads but does not draw them together completely. When larger it fastens one leaf on top of the other—one pinna of a leaf, that is, onto the top of another pinna and lives between them on the underside of the upper, often joining the edges of the one beneath to make it semi-tubular. The larva turns pinkish before changing to a pupa which it does in due time, after wandering a bit as a rule, on the underside of a leaf-pinna, sometimes quite openly, sometimes with another pinna as covering below. The pupa is fixed to the leaf by the tail and a body-band. The larva, before changing, also develops bands of dark spots which subsist in the pupa. All the nests, cells, houses or shelters, by whatever names we choose to call them, are somewhat thickly and evenly lined or carpeted with silk. The pupæ are quite frequently found on dead leaves round the base of the palms (*Phœnix*) on which the larva feeds—these leaves are generally still attached to the palm.

The butterfly is a fast flier, as far as as the writer has observed, is rarely seen. Why this is, is not known. Perhaps because it keeps to the taller trees. It is rarely seen at flowers and is generally in ragged condition when caught. Its habitat in the Kanara District of Bombay is the opener ghat jungles from sea-level upwards to somewhere in the neighbourhood of 3000′. Its distribution is said to be: India generally; Burma; Andamans; Ceylon; Siam; Malay Peninsula; Malay Archipelago. It is probable that it does not inhabit the plains at all and that it is confined to the damper hill ranges throughout its habitat. The flight is strong and rapid and, as far as has been observed, fairly straight though it is difficult to follow. It is there on a flower or leaf and next moment it is gone—that is the usual experience. The food-plant of the larva is *Phœnix acaulis,* Roxb., the Wild Date that grows on the Western Ghats in Bombay in the opener places where the soil is dry and porous, very dry in the hot weather. It is more than probable that it feeds also on other palms though it has never been bred but on the one by the writer of these papers.

Note in 1925.—Some dozens of larvæ were obtained at Balemani, up the Kalinaddi River from Karwar (Kanara), in September of this year. They were of all sizes and a few pupæ were likewise found. Originally, when first discovered in identically the same locality, caterpillars were collected in December, over twenty years ago. Each time, now and then and on several occasions between, some dozens were found and each time not more than 20 per cent of the caterpillars produced butterflies. They died; some parasitized, others apparently out of mere 'cussedness'. The eggs are always much ichneumoned and, if left for any time before being gathered, are nearly invariably thus damaged, as are most of the eggs of *Gangara thyrsis* and *Suastus gramius* observed on the same palms. The land where the palms grow is flat at the foot of high hills, widths of half a mile or so between them and the Kalinaddi River; a park-like country with grassy spaces and often very open forest with small deciduous trees in groups or forming patches of real forest. It is near the hills that the palms grow amongst undergrowth and grass, often at the root of some tree and under its shade. A very pleasant country in the months of September-October, but very hot and rather bare when the undergrowth is gone and the trees are losing their leaves.

Genus 36.—Iambrix

Imago.—Small insects of low, weakish flight, fond of sitting on foliage near the ground, practically on it often; frequenting forests and hills with a fairly heavy rainfall—probably not below 40 inches; both the wings of dark-brown hue above and below with a curve of equal-sized, discal dot-spots on the forewing upperside but the hindwing immaculate or nearly so; resting with the wings closed over the back, taking short flight to return to the same perch; quite fond of flowers; eschewing too bright sunlight. There are two species only in India, the one, *I. stellifer,* (Butl.) inhabiting Burma, the Malay Peninsula and Annam; the other, *I. salsala* (M.), much more widely distributed as shown below. There are six other species known from the Malayan Archipelago.

Antennæ.—More than half the length of the costa of forewing with the club gradual, moderately thick, the crook widely-curved back not reaching a right angle, pointed.

Palpi.—Erect; second joint densely scaled, the scales rather inclined to stick out; third joint slender, long, pointed, scaled.

Hind tibiæ.—Rather longly, fringed, with two pairs of spurs.

Forewing.—Vein 12 reaches costa before end of cell; 11 from well beyond middle of cell; straight; cell somewhat short but more than half the length of the costa; discocellulars in an erect line, the lower the shorter so that vein 5 is nearer to 4 than to 6 by very little—but the cell is bent up a good deal at end between 3 and 4; vein 3 from close to end; 2 from a little beyond middle; costa evenly arched; apex blunt; wing short and comparatively broad; outer margin rather strongly rounded-convex, a little shorter than hinder (inner) margin.

Hindwing.—Vein 7 from close to upper end of cell; discocellulars faint, outwardly-oblique; 5 hardly traceable; 3 from close to lower end, practically against 4 at origin; 2 from well beyond the middle.

Egg, larva, pupa, habits.—See below as there is only one species of which they are known.

238. **Iambrix salsala** (M.).—Male. *Upperside* dark olive-brown with an orange tint because of bright red-orange, long scales that are most thickly distributed above vein 12 on the costa; in the cell, especially in its base; in interspace 1 as far out as half length of cell and below vein 1 along inner margin on forewing; and because of long, decumbent, orange hairs in the same places on hindwing, as far down as vein 1*a*. Forewing with a series of discal spots of orange scales in interspaces 1 (in which there are two, one above the other) to 8, this band of spots at first obliquely outwards from just beyond middle of vein 1 to interspace 5, the recurved to costa with the three lowest ones by far the largest, decreasing in size somewhat upwards. There is only a very slight fringe of hairs along the inner margin. Hindwing immaculate. *Underside* rather paler and duller. Forewing with, generally, a white dot towards upper end of cell and one or more of the discal spots of the uppersides, pure white, represented in interspaces 3, 4 and upwards; the orange scaling is more or less confined to a broad band along the costa occupying the whole apex and continued, narrowing, downwards to vein 2, the area below vein 2 generally paler to inner margin and often with a pale indication of the two spots on the upperside in interspace 1; the white dot-spots, if present, are generally surrounded by a brown-blackish margin without orange scaling; and, if absent, by brown spots denuded of that scaling. Hindwing with the base covered with yellower scaling than the rest; and with a series of postdiscal white spots in a curve from vein 1*b* to costa, one in each interspace, each one surrounded by a denuded brown border; any and all of these white spots may be absent and the orange scaling may be very bright or exceedingly dark-brownish.—Female. *Upperside* paler, duller. Forewing with all the spots in interspaces 1

to 8 always developed and pure-white with the exception of the two in interspace 1 which are yellow, the upper end of the two often very minute. Hindwing as in the male. *Underside* exactly as in the male except that all the spots are present on the forewing, pure-white except those in interspace 1 of forewing where they are very pale besides being yellowish. *Cilia* alternately brown and ochreous with brown base; on the underside often with extreme tips orange. Antennæ black; club and shaft ochreous on the underside, the former with black tips at joints, the crook dark dull-red. Palpi above black, below bright ochreous including the third, slender joint which, however, has a black tip. Head, thorax bright ochreous-yellow above, the abdomen more orange over a brown ground-colour, chiefly due to the segmental bands being orange with a few orange scales elsewhere; below, thorax and abdomen are light-orange in the male, yellower in the female. Expanse up to 27 mm.; the female not being any larger than the male as a rule.

The above is taken from a long series of specimens bred and (very few) caught in N. Kanara District, Bombay. Long ago these Kanara insects were called sometimes *salsala,* sometimes *stellifer* by such experts as Lionel de Nicéville and E. Y. Watson who both, at different times, visited the District and saw the specimens. *Iambrix salsala* is a very variable insect in the presence or absence of the white or yellow spots and it would not be difficult to choose a male and female to fit *stellifer* to a nicety. The genitalia have not been noticed in publications, they are not mentioned by Elwes and Edwards in their Revision of the Oriental *Hesperiidæ* in the *Transactions of the Zool. Society,* vol. xiv, part iv, No. 11.—Oct., 1897; who, however, state that *stellifer* is a good and distinct species. Watson, also, in his Proposed Classification of the *Hesperiidæ* published in the *Proceedings of the Zool. Society of London,* January 17, 1893, says it is quite distinct from *salsala.*

Egg.—The *shape* is that of a depressed limpet or dome, rather more than one-third as high as broad, standing on a narrow or low, shelving rim. *Surface* only slightly shining, covered with obscure, fine-walled, 4 to 6-sided cells of irregular size that are at most 0.025 mm. in diameter except the depressed micropyle-surface on the top which is obscured to a certain extent by a scale-like skin and is 0.185 mm. across; the shelving rim is diaphanous-glassy, 0.05 mm. high and divided into sections by 42 meridional, thin ridges, all very fine and low but not extending onto the dome-surface. *Colour* dark blood-red except the glassy, shelving rim. B: 0.95 mm.; B: 0.35 mm.

Larva.—This is rather the *shape* of the rest of the subfamily larvæ with the broadly long-semicircular segment 14, the body thickest at middle, narrowing much less to hinder end than to the small neck but to that chiefly in segments 3, 2, the head being large compared to that neck; anal segment sloping to end dorsally with 13, the end slightly thickened round the free margin and set with much longer hairs than the rest of the body (the margin is); prolegs and true legs short, the ventrum flattened; *head* triangular, 2.5 mm. broad by about the same height, thick, the surface coarsely cellular-rugose, covered with minute, light-rusty coloured, erect or semierect hairs over the whole area which are, perhaps, 0.05 mm. long or less and not in the least obscure the surface or colouring; some longer hairs about mouth-opening as usual; the colour of the head is very light-yellow with the hinder margin bordered next the neck diffused-narrowly rusty-brown or blackish with a broad, similarly coloured stripe including the eyes separating cheeks from face up to vertex of each lobe—there is a very slight triangular sinus on vertex of head dividing it into two lobes—and the two stripes or bands may or may not be joined across vertex of head: a similar band, usually much lighter in colour, starts at base of clypeus on each side and runs up each lobe-face to about middle of head or higher; the false clypeus is thinly outlined with brown from apex to half way down, the true clypeus is completely outlined brown or blackish; the true clypeus is triangular, rather higher than broad with an acute apex and reaches half way up the face; the false clypeus reaches a little further, a not extremely narrow strip on each side, with the apex also acute; labrum rather more than a third of the true clypeus in length by rather less than twice that width, rusty in colour and with the hinder margin straight; the ligula is translucent-whitish, kidney-shaped, as long as labrum and very nearly as broad as labrum with the sinus one-third depth, rounded taking up one-third the whole width, the lobes on each side broadly rounded; antennal, basal member as well as third joint whitish; mandibles of the block type, rusty-coloured with black-rusty borders, the cutting edges quite entire; eyes arranged 1 to 4 in a very gentle curve, equispaced, about one eye-diameter apart (3 and 4 perhaps a bit further apart), 3, 4, 6 in a straight line but 4 and 6 three eye-diameters apart, 5 behind making a nearly perfect-equilateral triangle with 4, 6. *Surface* of body with segment-margins well marked; with the usual impressed, very fine, transverse six lines parallel to hinder margin of segments and occupying their hinder halves or more; the whole body covered with extremely minute, erect, light hairs not visible except under a high-power glass, those on the anal margin much longer though still short, quite visible to the naked eye. *Spiracles* very light-brown, rather small, broadly-oval, flush; those of 2 and 12 much larger. *Colour* of body is green-yellow, plentifully sprinkled with small, more or less pure-green dots (the bases of the minute hairs); segment 2 whitish-colourless; ventrum darker-green; prolegs and true legs rather lighter green; there is generally a dorsal, dorsolateral and supraspiracular, darker green, longitudinal line. L: 25 mm.; B: 3 mm.

Pupa.—This is in *shape* rather like that of *Telicota bambusæ,* with the eyes prominent, the front square, the shoulders to end of wings broadest, very slightly thickest in middle, the cremaster triangular, strong, large, basally wedge-shaped, distally thin, dorsally flat with thin, lateral extensor ridges limiting the flat dorsum, rather pointed at extremity where is situated a bunch of short, robust, nearly shaftless hooklets of a rusty colour; segment 13 very short, hardly one-third of 12 in length, about as long as the very anterior-marginal portion of 14 before the cremaster proper begins with 14 itself longer than 12+13 together, indeed very nearly equal in length to 11+12 together; 11=12+13 together; 10 a bit longer=9=8; segment 2=12, with front and hinder margin parallel, straight, an oblong-transverse piece coming to points laterally in front of the very large spiracular expansions; thorax not very much humped, the hinder margin a quarter-circle more approaching a parabola as it is somewhat narrowed at apex of curve, meeting the wings in a broadly-rounded, rather deep angle of 90°; *head* broad, eyes prominent with the crescent linear; vertex dorsal, slightly ascending towards 2 and with the frons perpendicular to longitudinal axis of the body; the clypeus triangular or hexagonal (the distal side very minute, the proximal side really a curve instead of three sides); the ligula diamond-shaped; the proboscis reaching free to end of segment 9; the forelegs not quite attaining the middle of wings; the midlegs and antennæ nearly three-quarters. *Surface* of pupa dull, covered with comparatively long, nearly decumbent, soft hairs that are quite a spiracle-length long and very fine, not hiding the surface; on the head-frons, segment 2 and thorax they arise from tiny, rather prominent tubercles; on the eyes they are a trifle longer and erect; on segment 14 along the edges ventrally they are much longer, nearly double the length and thicker, inclined to hooks at the ends; segments well-defined; abdomen slightly wrinkled minutely and also having some small hair-tubercles. *Spiracles* of segment 2 with enormous expansions that are semicircularly funnel-shaped, the base of the semicircle along front margin, the funnel on thorax behind it, quite as broad as the length of segment 2 with a perforation at the bottom; other spiracles about one-ninth of a segment-length, oval, prominent, nearly twice as long as wide, red-brown; the funnel of spiracle of segment 2 also brown. *Colour* rusty-brownish, deepest on head and thorax and segment 2, paler a good deal elsewhere, covered generally with a white, cereous powder exuded by the larva before changing with which the cell is also covered inside. L: 16 mm.; B: 4 mm.; H: 4 mm. at thorax.

Habits.—The eggs are laid on the undersides of blades of grass; even on the top occasionally; the little larva makes a cell at the tip of the leaf by joining the edges; but, later on, lives free as often as not, making a lax cell of the same sort to retire to when it feels inclined; the pupal cell is made of a few—as often as not dry, dead—leaves which are rather tightly closed into a cylindrical tube, the inside of which is often full of a white powder, this tube fitting closely to the pupa; the pupa attached by the tail inside it. The butterfly is found all over the N. Kanara District in jungles, keeps close to the ground and is fond of sitting on the upper surfaces of leaves near the ground; flies quickly but somewhat weakly, often returning to the same perch. It is easy to capture on its leaf. It is fond of flowers but does not like the hot sun and keeps to the shadier places. It is often seen by the sides of paths and on the edges of open spaces. The food of its larva is a particularly long-leafed, soft grass that grows in the damper parts of the District from sea-level upwards and inwards to the top of the Western Ghats. The distribution of *Iambrix salsala* is given by Swinhoe as Sikkim, Assam, S. India, Ceylon, Burma and Perak and Java; further states that it is 'In our collection from Sikkim, Rangoon, Kandy, Khandala, Poona, Calcutta, Ranikut and the Khasia Hills; recorded by Manders from the Shan States; by Aitken and Comber from the Konkan; by Watson from the Chin Hills and Chin Lushai; by Wood-Mason from the Palni Hills; by Aitken from Bombay; by de Nicéville from Calcutta and Sikkim; by Hampson from the Nilgiris; by Elwes from the Karen Hills, Naga Hills, East Pegu, Gangam, Perak and W. Java; by Davidson, Bell and Aitken from Karwar; our figures of the larva and pupa are from Davidson's original drawings.' (*Lepidoptera Indica,* vol.x, p. 147. The figures are on plate 791 of the same book, 2 the male, 2*a* the female, 2*b* the underside male, 2*c* the underside female and 2*d* the larva and pupa).

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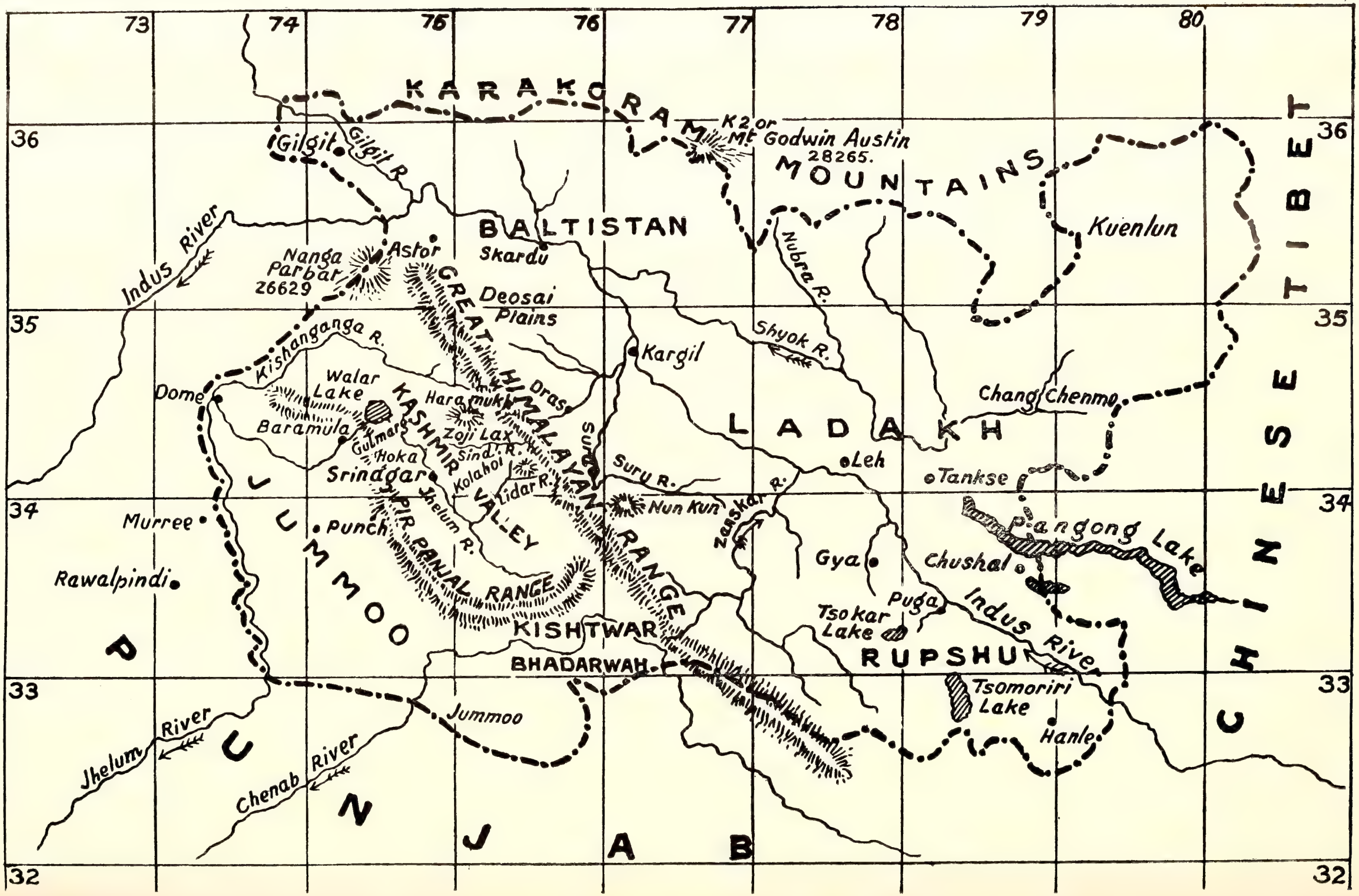
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Deosai Plains
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Shyok R.
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Kishanganga R.
Walar Lake
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Hoka
Kolahoi
Lidar R.
Srinagar
Suru
Suru R.
Nun Kun
Zanskar R.
Chang Chenmo
LADAKH
Leh
Tankse
Pangong Lake
Chushal
Gya
Puga
Tsokar Lake
Indus River
RUPSHU
Tsomoriri Lake
Hanle
Murree
Punch
Jhelum R.
PIR PANJAL RANGE
JUMMOO
KISHTWAR
BHADARWAH
Rawalpindi
Jummoo
Jhelum River
Chenab River
PUNJAB

DOMINIONS OF THE MAHARAJA OF KASHMIR

NOTES ON THE BIRDS OF KASHMIR

BY

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PART I

(*With a Plate and a Map*)

The Dominions of the Maharaja of Kashmir cover an area of about 90,000 square miles of mountainous country which is bounded on the north by the Karakoram Mountains, on the east by Chinese Tibet, on the south by the Punjab, on the west by Frontier Tribal Territory, the North-West Frontier Province and the Punjab.

It comprises the following main Divisions :—

(1) The Kashmir Valley.
(2) The Kishenganga Valley
(3) Gilgit.
(4) Astor.
(5) Baltistan.
(6) Ladakh (including Rupshu.)
(7) Jammu (including Punch.)
(8) Kishtwar.
(9) Bhadarwa.

The area included in the State extends from points on the southern boundary which are only 1,000′ above sea level up to many peaks in the Karakoram Mountains which exceed 25,000′ and one of which, Mount Godwin-Austen, is over 28,000′ and probably the second highest mountain in the world.

As a result of such differences in altitude the climate varies from semi-tropical to arctic, and from a moderately moist country, in the Valley of Kashmir to extreme dryness with desert conditions, in Ladakh.

An idea of the altitudes to be met with in the various parts of the State may be obtained from the following figures :—

Kashmir Valley, 5,000′. Side valleys up to 15,000′.
Kishenganga Valley, 2,000′ up to 12,000′.
Gilgit, 4,300′ upwards.
Astore, 7,800′ ,,
Baltistan, Skardu, 7,500′ Mountains up to 24,000′ and higher.
Ladakh, 9,000′ to 18,000′. Mountains up to 22,000′.
Jummu, 1,000′ to 14,000′.
Kishtwar, 3,000′ to 16,000′.
Bhadarwa, 3,000′ to 12,000′.

With such wide differences in climate and elevation there are corresponding changes in the fauna and flora. The outer hill slopes of Jammu support a forest of mixed deciduous species, as well as the Long-leafed Pine, and a number of birds which do not penetrate into the Valley of Kashmir. Similarly a certain number of Eastern Himalayan forms are found in Kishtwar or Bhadarwa which do not enter the Kashmir Valley.

The Valley of Kashmir is nearly level and contains much cultivation, rice, maize, etc., and includes several lakes and many extensive swamps which are a paradise for aquatic birds.

The chief trees found in the valley are Poplars, Willows, Mulberries and the Plane (Chenar). The side valleys are well forested, the lower slopes with Walnut, Hazel, Perrottia, Elm, etc., passing up into Blue pine, Silver and Spruce firs, Deodar (local), Yew, Cherry, Maple, Birch and Juniper. Rhododendrons are local and rather scarce. The total absence of oaks is a marked feature of the forests of Kashmir.

In Ladakh and Baltistan, the rainfall is very small and in the former tree growth is altogether absent except in very restricted areas where irrigation from snow-fed streams has permitted plantations to be made. Here we find Poplars and Willows.

Thorny scrub is also found in the vicinity of streams and low thorny bushes, e.g., *Caragana* spp. on the most favourable slopes not far from streams, The birds found in Ladakh are largely distinct from those occurring in Kashmir proper.

The birds described below comprise those met with by the writer in the course of a number of tours undertaken during the four years 1922 to 1925 inclusive, the areas visited being :—

(1) The main Valley of Kashmir.
(2) Gulmarg and Tosha Maidan in the Pir Panjal Range.
(3) The Sind and Lidar Valleys.
(4) Haramukh Mountain and the surrounding country.
(5) Ladakh, including Rupshu, Nubra and the Pangong Lake.
(6) The Suru and Dras Valleys.
(7) Nunkun and the head waters of the Wardwan Valley.

Birds recorded as occurring in areas not visited by me viz. (1) Jummu, (2) Kishtwar, (3) Bhadarwah, (4) Baltistan, (5) Gilgit and (6) the Kishanganga Valley have not been included. Of these Jammu would add a large number of species found in the western submontane hills. The other areas would not probably add many species.

In the following notes the measurements of eggs are given in millimetres. 'L' stands for the longest egg, 'S' for the shortest, 'B' the broadest, and 'N' the narrowest.

1. Corvus corax tibetanus. The Himalayan Raven.

This species is not found in Kashmir proper, but is fairly common throughout Ladakh in dry rocky country from about 10,000′ altitude up to the snow line at about 16,000′ or 17,000′. They are chiefly seen in the neighbourhood of villages but they are also found in rocky desolate country far from habitations. They are very common in and around Leh (elevation 11,600′) where I have seen as many as a dozen at a time feeding in the cornfields.

They eat grain as well as flesh. The note is a hoarse croak. They are very early breeders, nidification commencing about the middle of February, fresh eggs being obtainable in March and April.

Nests are usually placed in very inaccessible positions on cliffs. Only rarely can they be reached without a rope. A nest found by me near the Tsokar Lake at 15,000 ft. was composed of sticks, densely lined with yak's hair.

Two eggs obtained are bluish-green in ground marked with sepia and grey. They are rather broad ovals. They measure 50·0 × 35·3 and 47·3 × 34·3 respectively.

2. Corvus coronoides intermedius. The Himalayan Jungle Crow.

Fairly common in Kashmir, especially in the side valleys and near 'margs' (open grassy glades) where sheep and goats congregate. They are not very common in the main valley, but are much more numerous as one ascends the hills, and they are found up to the limits of sheep grazing i.e., up to about 12,000′. They are usually seen in pairs but where food is plentiful, e.g. near large villages or where sheep collect, they may be seen in parties of a dozen or so.

They are bold and at the same time extremely wary. They destroy many small birds' nests, devouring both eggs and young.

They build large nests of sticks in trees from 20′ to 40′ up, which are lined with a dense layer of wool and hair. Four or five eggs are laid towards the end of April or early in May, of the usual crow type.

14 eggs, taken in the Sind Valley at about 7,000′, average 42·5 by 29·7.

3. Corvus corone orientalis. The Eastern Carrion Crow.

This species is not common in Kashmir but on crossing the Great Himalayan Range into Ladakh it is at once seen, and is found, together with the Raven, in the Indus Valley, and side valleys (Dras, Suru, etc.) from 9,000′ to about 12,000′. It is not numerous anywhere, but a few pairs are to be found at intervals all along the Treaty Road from Dras to Leh.

The note of the bird is distinct from that of the Jungle Crow, being hoarser and more like that of the Raven. Several nests were found in willow trees early in May, some empty, others with eggs in various stages of incubation. The eggs are indistinguishable from those of the Jungle Crow. The nests are also quite similar to those of the latter bird.

Eggs vary in length from 47·3 to 39·4 and in breadth from 30·5 to 27·8, the average of 21 eggs being 42·5 by 28·1.

4. Corvus splendens zugmayeri. The Sind House Crow.

This is the common house crow of Srinagar, where it is found in very large numbers. It is also found in Baramula, at the entrance of the valley and in the villages between Srinagar and Baramula, but not elsewhere in the Kashmir Valley. Passing down the Jhelum Valley it is not found until one reaches Garhi, at 2,600′ elevation, 60 miles from Baramula. The Kashmir Valley community would therefore appear to be quite isolated and may eventually become a distinct local race. The crow is resident throughout the winter and does not seem to mind the snow. They breed in and around Srinagar in willow and poplar trees. Five is the full complement of eggs laid, which vary considerably in size and colour. Longest egg, *43·2* × 27·4. Shortest, *37·0* × 26·1. Broadest, 40·5 × *27·7*. Narrowest, 40.5 × *26·0* Average of 17 eggs, 39·0 by 26·6.

5. Corvus monedula sœmmeringii. The Eastern Jackdaw.

This species is exceedingly common throughout the Valley of Kashmir, where it is a resident species. They extend up the side valleys to about 7,000′ but they are not common out of the valley. They are most numerous in and around Srinagar. Their ordinary call note is similar to that of the European Jackdaw.

In the winter they leave Srinagar before sunrise in enormous flocks composed of thousands of birds which fly south along the Jhelum River to feed in the cultivated fields along the river often many miles away and they return after sunset in similar flocks.

In February they pair and select nesting sites, generally holes in chenar or willow trees or in banks. Building does not commence till April and eggs are laid in the first week of May. Nests are composed of sticks, lined with wool and hair, or sticks may be dispensed with, 4, 5 or 6 eggs are laid, which resemble those of its European cousin.

After breeding, early in August, flocks of birds repair to the open grassy slopes above tree level at from 9,000′ to 12,000′ returning to the valley when driven down by snow in September or October.

The following egg measurements were taken :—*L*. *39·1* × 25·6. S. *30*·0 × 24·0. *B*. 35·4 × *26·3*. N. 36·6 × *23·6*. Average of 55 eggs, 35·1 × 24·8.

This species is not found in Ladakh except as a very rare straggler.

6. Pica pica bactriana. The Kashmir Magpie.

This species is common throughout the desert, treeless country of Ladakh, from 9,000′ up to 12,000′ and rarely as high as 13,000′. It is not found in Kashmir proper, and the trivial name 'the Kashmir Magpie' is therefore misleading.

Unlike its European relative it avoids forest country and is found chiefly near villages, provided there is a tree or a bush in which to build its nest.

The only trees found in Ladakh are willows or poplars, which are planted singly or in small plantations on irrigated land near villages, and such trees afford nesting sites for the magpie. In the absence of trees the magpie will build in a thorn bush only 5 or 6 feet from the ground.

Nests are composed of sticks, roofed over with thorns. Inside is a solid cup of mud which is lined with fine roots. Often several nests may be found superimposed, of several consecutive years, the uppermost only being occupied. 5, 6 and even 7 eggs are laid which are similar in colour to those of the English Magpie. They measure :—

In length from 43·1 to 32·4. In breadth from 27·1 to 23·1. The average of 112 eggs is 36·5 by 24·9.

7. Urocissa flavirostris cucullata. The Western Yellow-billed Magpie.

This is not a very common bird but is found generally distributed in fir and mixed forest from 4,000′ in the Jhelum Valley up to about 8,000′ in the silver fir forest. They are generally met with in pairs or in small family parties.

They breed in May. The nest is rather small, cupshaped, and made of small sticks lined with roots.

8. Nucifraga multipunctata. The Larger-spotted Nutcracker.

This bird is generally distributed throughout the fir and pine forests of Kashmir at from 7,000′ to 9,000′, but is only locally at all common, in forests of blue pine. They feed chiefly on the seeds of the blue pine. They have a hoarse grating call.

Nests are difficult to locate. They are built in pine and fir trees at a considerable height from the ground. Eggs are laid chiefly early in May.

9. Pyrrhocorax pyrrhocorax. The Red-billed Chough.

This is a common species both in Kashmir and in Ladakh, at high elevations. They are inclined to be gregarious, and are found in summer at high elevations only from about 10,000′ up to 17,000′. They are generally most numerous in Ladakh in the vicinity of villages where they feed in the fields in company with Ravens and the Blue Rock and Blue Hill pigeons.

In the winter, especially in January, they descend to about 5,000′ or 6,000′ and may then be seen in the valley near Srinagar.

They also frequent wild rocky precipitous country far from human habitations. Their nests are often solitary, placed on inaccessible cliffs, but occasionally also they breed in communities, as near Leh where a sandy cliff contained upwards of 40 nests all more or less accessible with a rope or a ladder. In this case the nesting holes in the soft sandstone had evidently been excavated by the birds themselves.

Nests are composed of wool and hair with or without a foundation of sticks.

Eggs are laid early in May, three or four constituting a full clutch.

The eggs are whitish in ground colour, marked all over with yellowish brown and grey. L. and B., 43·9 × 28·6. S. and N., 36·8 × 26·3. The average of 36 eggs is 39·2 by 27·6.

10. Pyrrhocorax graculus. The Alpine Chough.

This species is found generally distributed at high elevations 10,000′ to 16,000′ in Kashmir and also, though much less common than the red-billed variety, in Ladakh. I found it nowhere so common as the red-billed chough, with which it frequently associates.

Nests are built on precipices at high elevations and are usually quite inaccessible.

11. Parus major kaschmiriensis. The Kashmir Grey-Tit.

This tit is common in the Valley of Kashmir extending up the side valleys and into the hills up to an elevation of about 7,000′ and rarely higher. A very similar tit, probably the same species, occurs also in the Indus Valley from 9,000′ to 11,000′ and also at Leh, and in the Shyok and Nubra Valleys.

They remain in the Kashmir Valley throughout the year. Breeding commences early in May. A common site for the nest is a deserted nest hole of the little Blue King-fisher. More rarely they build in holes in trees.

The nest is the usual pad of hair, and 6 to 9 eggs are laid resembling those of the British Great Tit but smaller. L., *20·1* × 13·5. S., *16·4* × 12·2. B., 18·5 × *13·9*. N., 16·4 × *12·2*. Average of 31 eggs 17·5 × 13·4.

12. Parus monticolus. The Green-backed Tit.

This species, so common in the Western Himalayas generally, is rather scarce in Kashmir.

It was observed on 2 or 3 occasions only near Gulmarg at about 9,000′ elevation.

13. Ægithaliscus concinnus iredalei. The Red-headed Tit.

This little tit does not occur in the Valley of Kashmir. It was only observed in the Jhelum Valley at about 3,000′ in March. It is doubtless common in the hills of Jammu south of the Pir Panjal Range.

14. Ægithaliscus niveogularis. The White-throated Tit.

This species is rare in Kashmir. A single specimen only was observed feeding with other tits and *Phylloscopi* near Gulmarg at 9,500′. This was on September 20.

15. Lophophanes melanolophus. The Crested Black Tit.

This little tit is exceedingly common in the pine and fir forests on the hills surrounding the main and side valleys from about 6,500′ up to 11,000′. In the winter months they descend to lower elevations and are common around Srinagar.

They hunt trees for insects in company with *Phylloscopi* and other small birds.

They breed in holes in trees in May and June generally in fir forest, the nest being the usual pad of wool and hair, on a substratum of moss.

5 or 6 eggs are generally laid, which are white, richly marked with chestnut.

Eggs give the following measurements :—

L., *17·2* × 11·1. S., *14·6* × 11·9. B., 14·6 × *11·9*. N., 14·9 × *10·9*. The average of 11 eggs is 15·8 by 11·5.

16. Lophophanes rufonuchalis rufonuchalis. The Simla Black Tit.

This bird is not uncommon in the silver fir forests where it is found along with the preceding species, than which however it is much less common. They are also found in the Valley of Kashmir in the winter months.

This bird is superficially very similar in appearance to *L. melanolophus* from which however it may be readily distinguished by (1) its larger size, (2) its general darker colour and (3) the absence of wing-bars.

17. Sylviparus modestus simlaensis. The Simla Yellow-browed Tit.

This bird is only to be seen in Kashmir on the autumn migration, small flocks occurring in Srinagar towards the end of September or early in October, hunting over trees after the manner of tits.

Nothing is known about the breeding of this species.

18. Sitta kashmiriensis. Brooks's Nuthatch.

Fairly common in mixed forest from about 7,000′ to 9,000′. It is a quiet bird resembling in its habits and appearance the British Nuthatch.

A nest was found in the nest hole of a Pied Woodpecker in a dead birch tree, the hole being about 20′ from the ground. This was at 9,000′ elevation On June 29, it contained 3 unfledged young. The nest hole had been reduced in size by the construction of a ring of very hard mud masonry.

19. Sitta leucopsis leucopsis. The White-cheeked Nuthatch.

This is a fairly common bird in the silver fir forests from about 8,000′ to 10,000′.

It is readily recognized by its harsh call, generally uttered from near the top of a lofty tree. The birds keep very much to the crowns of the taller trees.

Nidification commences in May, and natural holes in coniferous trees are utilized as nesting sites. Nests are usually at some 20′ or more from the ground. No attempt is made to reduce the size of the entrance hole with mud as in some other species.

20. Trochalopterum variegatum simile. The Western Variegated Laughing-Thrush.

This is a fairly common species in the upper hill forests from about 9,000′ to 11,000′. Open forests of silver fir and birch, where there is plenty of young growth, rhododendron, etc., are preferred. It is commoner on the Pir Panjal Range than on the mountains east of the Kashmir Valley.

21. Trochalopterum lineatum griseicentior. The Simla Streaked Laughing Thrush.

Common in the hill forests, especially in miscellaneous scrub jungle, from 6,000′ up to about 9,000′, both on the Pir Panjal and lower slopes of the Himalayan Range. About the last week in September many birds leave their breeding grounds, descending to the main valley. They may be seen in and around Srinagar throughout the winter months.

Breeding commences in June, nests being placed in low bushes or on the ground, in grass, on steep banks. From 2 to 4 eggs (generally 3) are laid, the measurements of which are as follows:—L. and B. *27·4* × *19·9*, S., *24·1* × 18·3. N., *24·7* × *17·7*. Average of 16 eggs 25·8 by 18·7.

22. Molpastes leucogenys leucogenys. The White-cheeked Bulbul.

This bird is exceedingly common throughout the main Valley of Kashmir, where it is resident. It is also found, for a short distance only, up the side valleys up to an elevation of about 6,000′ only. They are numerous in the gardens and wooded compounds in and around Srinagar where they frequently become very tame, entering houses and house-boats in quest of food. In the winter months they live to a great extent on house-boats. They breed in April and May, the nest being placed in any low bush, or in fruit trees, etc. Three, more rarely four, is the full complement of eggs. Egg measurements are as follows :—

L., *24·2*×17·1. S., *21·5*×16·6. B., 22·5×*17·5*. N., 22·6×*16·0*. Average of 33 eggs, 22·8 by 16·7.

23. Microscelis psaroides psaroides. The Himalayan Black Bulbul.

A very common bird in the early spring in and around Srinagar where they feed in flocks, largely on the fruit of the Persian Lilac tree (*Melia azedarach*). By April or early May they move up to their breeding haunts in the lower mixed forests at about 7,000′.

24. Certhia himalayana. The Himalayan and Turkestan Tree-Creepers.

Kashmir is the meeting ground of two races of this species viz. (1) *C. h. himalayana* and (2) *C. h. tæniura*. They are both common birds in Kashmir. In the summer months they are found chiefly in the fir forests from 7,000′ to 10,000′. In winter they descend to the Valley of Kashmir and many go still lower to the foot hills and even as far as Rawalpindi and Peshawar. They breed in the fir forests chiefly between 8,000′ and 9,000′, a favourite nest site is behind the semi-detached bark of a big spruce or silver fir. Nests are from 5 feet from the ground upwards. The bird is an early breeder, eggs being obtainable throughout May. Both nests and eggs resemble those of the English bird.

25. Certhia familiaris hodgsoni. Hodgson's Tree-Creeper.

This species is not nearly so common in Kashmir as the preceding from which it may be recognized at close quarters by the absence of cross barring on the tail. I observed it on several occasions in the silver fir forest above Gulmarg and shot one specimen late in July in the Lidar Valley in open birch forest at 12,000′.

26. Tichodroma muraria. The Wall-Creeper.

This species is fairly common in the Valley of Kashmir from October to March, frequenting precipitous rocky and sandy cliffs on warm sunny aspects at this time of the year. Many birds migrate even further in winter, to the foot hills and plains of the Punjab and they may always be seen at this season on the sandstone cliffs along the Soan river near Rawalpindi. Early in April they leave their winter quarters resorting to much higher altitudes, the majority crossing the Himalayan barrier into Ladakh, where they breed between 11,000′ and 13,000′. Breeding birds were observed in June and July in the Gya Valley, also near Tankse and Khardong, all at about 12,000′. Nests are built in holes in precipitous rocky ground often near streams. Some birds also breed on the Kashmir side of the Himalayan Range, a pair having been observed in July at 12,000′ near the headwaters of the Lidar.

27. Troglodytes troglodytes neglectus. The Kashmir Wren.

This little wren is a common bird throughout the silver fir forests of Kashmir on the Pir Panjal as well as on the Himalayas. In summer they are found from about 8,000′ upwards throughout the silver fir and birch zones and even above the forest limit up to about 12,000′ in boulder-strewn and rocky ground.

In the winter these birds move down to the valley and may be seen in and around Srinagar. They probably go still lower down the Jhelum Valley but apparently never extend their migration to the plains.

In their habits they resemble the British wren. They have the same loud, rapid, cheery song. Nests and eggs also resemble those of its western relative. They are usually placed in sheltered places, in the upturned roots of a big fallen tree, in a crack in a leaning tree, or in the roof of a deserted Gujars' hut. Four or five eggs are laid in June which measure as follows :—L., *18·3*×11·9. S., *15·3*×12·4. B., 16·9 × *13·3*. N., 16·3 × *12·0*. Average of 35 eggs, 17·0 by 12·5.

28. Larvivora brunnea. The Indian Blue Chat.

This is a fairly common bird from about 7,000′ to 9,000′ in rather open fir and mixed forest. The bird frequents brushwood in open parts of the forest and is a great skulker. Its loud clear notes are often heard, but the bird is rarely seen. Nests resemble those of the English robin but they often have a few feathers incorporated in the lining of the nest. They are built on the ground, either in steep banks or at the foot of a big fir tree, in the angle between two buttresses. The eggs are unspotted pale blue.

Nidification commences early in June. The Asiatic cuckoo often places her egg in the nest of this bird.

This species is equally common in the valleys of the Himalayas and on the Pir Panjal Range. It is migratory, disappearing altogether in October for Southern India.

Five eggs average 20·4 by 14·8.

29. Hodgsonius phœnicuroides phœnicuroides. Hodgson's Shortwing.

This species is locally commoner than the preceding which it somewhat resembles in its habits. It is equally shy and retiring. They are found at rather higher altitudes, from about 8,500′ up to 10,000′. They frequent dense scrub jungle of viburnum, juniper, etc., and avoid tree forest. The call of three notes is melancholy and characteristic.

The nest is placed about a foot from the ground in dense bushes, grass and tall weeds.

Eggs, generally 3 in number, are deep spotless blue. The bird is migratory, disappearing from Kashmir in October. Where they spend the winter months is not known.

Egg measurements are as follows :—L. and B., *23·9*×*16·9*. S., *20·6*×15·7 N., 20·8×*14·1*. Average of 31 eggs, 22·2 by 16·1.

30. Saxicola torquata indica. The Indian Bush-Chat.

This is one of the commonest birds in Kashmir on the lower, more open, rocky and bush covered slopes of the surrounding hills.

They are most numerous at about 6,000′ elevation, but are found up to about 8,000′ and occasionally higher.

They are migratory, arriving about the middle of March and departing early in October.

The male has a short little song in the spring. Breeding commences in May, nests being well concealed in holes under stones or at the foot of small bushes on steep, rocky hillsides.

Four or five eggs are laid which are pale blue, marked with faint chestnut spots in a zone at the large end. The Asiatic cuckoo frequently selects the nest of this bird in which to deposit its egg.

Egg measurements are as follows :—L., *19·0*×14·0. S., *15·6*×13·4. B., 18·9×*14·1*. N., 17·3×*13·1*. Average of 93 eggs, 17·3 × 13·5.

31. Oreicola ferrea ferrea. The Dark-grey Bush-Chat.

This bird frequents similar open bushy hillsides to the last, but is much less common.

It is found rather sparingly both on the Pir Panjal and Himalayan ranges, generally at about 7,000′ to 8,000′.

Nests and nesting sites are similar to those of the Indian Bush-Chat. Eggs, too, are similar to those of the last named species, but larger and generally paler. They measure :—L., *18·5*×14·5. S., *16·8*×13·8. B., 17·9×*14·5*. N., 18·5×*13·5*.

They disappear from Kashmir in the winter.

32. Œnanthe deserti oreophila. The Tibetan Desert-Chat.

This bird is found at high elevations only, in Ladakh. They frequent rocky, sandy, desert country, both plateaux and steep hillsides, from about 10,000′ up to 17,000′, where they are often the only birds to be seen. They are nowhere numerous.

They are early breeders, nidification commencing in May. Nests are placed under rocks or stones or in the ' mane ' walls, and are composed of small sticks and dry grass, lined with hair and feathers.

Four or five eggs are laid, which are pale blue lightly spotted or speckled with pinkish-brown. They measure in length from 24·2 to 20·8 and in breadth from 17·2 to 15·6. The average of 11 eggs bring 22·3 by 16·6.

These birds are occasionally seen in the Valley of Kashmir on the spring migration.

33. **Enicurus maculatus maculatus.** The Western Spotted Forktail.

Not uncommon in the side valleys of the Himalaya and Pir Panjal Ranges between 6,000′ and 7,000′. They frequent shady streamlets, where they breed in May-June, the nest being placed up against a mossy rock or overhanging bank close to the water.

34. **Microcichla scouleri scouleri.** : The Little Forktail.

This is a rare bird in Kashmir, being found at about 8,000′ by rocky hill streams and torrents. I only came across this species on two or three occasions, so it is evidently not common.

35. **Phœnicurus frontalis.** The Blue-fronted Redstart.

This species is found widely distributed, but at high elevations only, both on the Pir Panjal and on the Western slopes of the Himalayan Range. They frequent open rocky slopes above the forest limit at from 11,000′ to 13,000′. They are not nearly so common in Kashmir as further east in Garhwal. They breed in May, the nest being placed on the ground on a steep rocky slope under a rock or stone.

The eggs are pale cafe-au-lait faintly marked with pinkish-brown.

One nest was found in the Lidar Valley at 11,500′ on July 27, containing a half-fledged young cuckoo (*C. canorus telephonus*).

36. **Phœnicurus erythronotus.** Eversmann's Redstart.

A regular cold weather visitor to the Kashmir Valley, where it is found singly or in pairs in orchards, gardens, etc., from November to January. It is not very common.

37. **Phœnicurus ochrurus phœnicuroides.** The Kashmir Redstart.

This bird, which winters in the plains of India, is found on the spring and autumn migration in the Valley of Kashmir. Towards the end of April they all retire to their breeding haunts at high altitudes. The great majority cross the Himalayan barrier into Ladakh, but a few remain to breed on the Kashmir side of that range.

They breed at all elevations from about 10,000′ up to the snowline at 17,000′. Male birds are not infrequently seen breeding in female plumage. They are one of the commonest birds in Ladakh, being found in and around villages and cultivation as well as in desert tracts. The nest is built very frequently in a stone wall, or under a rock or stone on a mountain slope The bird has a pleasant little short song of 4 or 5 notes in the breeding season. The alarm call is a note resembling u-tick . . . hence the Ladaki name—' sin-tick ' for the bird.

Eggs are 4, more rarely 5 in number, pale or very pale spotless blue and sometimes almost white. Some eggs have a few pinkish spots on them.

A bird of this species was observed in July in the Suru Valley feeding a fully fledged young Asiatic cuckoo, though how the mother cuckoo obtained access to the nest of this redstart for purposes of oviposition is a mystery, as nests are placed in holes among stones.

38. **Phœnicurus erythrogaster grandis.** Guldenstadt's Redstart.

This bird occurs rather sparingly in Ladakh at considerable elevations only.

In the winter months they appear to move down to 10,000′ or perhaps lower in the Indus Valley. In May they move up to their breeding haunts at from 13,000′ to 16,000′. They frequent streams and mountain torrents. Superficially they strongly resemble *Chaimarrhornis*, the White-capped Water Redstart, from which they may however be at once distinguished by the white wing patch. Nidification commences early, fresh eggs being obtainable in the first week in June. Nests are rather bulky affairs, composed of wood and dried grass matted together and lined with hair and a few feathers.

The eggs, four in number, are white marked with pale rufous or chesnut and resemble well marked eggs of the English robin.

Seven eggs average 22·4 by 17·0.

39. Chaimarrhornis leucocephala. The White-capped Redstart.

This is a common bird in Kashmir on all hill streams from about 8,000′ to 12,000.′ In winter they descend to low levels and even to the plains, e.g. Rawalpindi. They breed chiefly at from 9,000′ to 10,000′ from May to July.

Nests are well concealed in holes in steep banks over a river or stream, in a cavity in the face of a rock or even in a hole in a tree.

The bird has no song but a characteristic very shrill call note. The colouring of the two sexes is identical.

Eggs are very pale blue marked with some shade of rufous brown. The average of 4 eggs is 23·1 by 16·3.

40. Rhyacornis fuliginosa fuliginosa. The Plumbeous Redstart.

This bird is found along all hill streams in Kashmir in company with the last species, but it does not ascend to such high altitudes, being rarely seen above 9,000′. The colour of the two sexes is quite different, the cock bird having a bright chestnut tail, whereas the tail of the hen bird is chiefly white. They breed in May and June. The nest is generally well concealed in a hole in a rock, stump or tree overhanging the water, less frequently in a hole in a tree at some distance from the stream.

The eggs, usually four in number, are very pale greenish-white spotted with chestnut-brown. L., *20·9* × 14·9., S. and N., *17·3* × *13·5*. B., 20·4 × *15·2*. Average of 14 eggs, 19·8 by 14·6.

41. Cyanosylvia suecica pallidogularis. The Eastern Red-spotted Blue-throat.

This species is not known to breed either in Kashmir or in Ladakh. It occurs in large numbers in the Valley of Kashmir in September and October on the autumn migration, frequenting the thick cover of maize fields and reed-beds.

As soon as the maize is cut the birds leave for the plains of India where they spend the winter months.

42. Cyanosylvia cyanecula abbotti. The Eastern White-spotted Blue-throat.

This species is fairly common in summer in Ladakh in the Indus Valley and its tributaries between 9,000′ and 11,500′. They are found chiefly along river beds and streams, and they are very partial to wet ground covered with a low thorny shrub, *Lonicera spinosa*, in fact they are rarely or never seen except in or near this thorny scrub, and wherever a decent-sized patch of this scrub occurs one may be almost certain of finding one or more pairs of this species.

They feed mostly on the ground near the patches of thorns, in which, at the least alarm, they speedily take cover. The male bird has a very fine song of loud, clear notes. Nidification commences in May, fresh eggs being available from the last week of May throughout June. The nest is a most difficult one to locate, being placed on the ground well concealed in grass at the base of a thorn bush. Except for the exit of the parent bird the nest would generally escape detection. The nest is composed of dry grass only. The eggs, 3 or 4 in number, are of a uniform pale sage green colour more or less suffused with very pale reddish brown.

The cock bird has a pure shining white or red spot on a deep glistening blue ground, or more rarely there may be no spot at all. The hen bird has also the blue-throat with a spot which is usually very pale rufous.

A number of nests were found with eggs in various stages of incubation and with young in the Indus-Suru Valleys from May 26, to the end of July. Measurements of eggs give the following figures :– L. and B., *20·0* × *15 0*. S., *18·5* × 14·6. N., 19·3 × *13·6*. Average of 20 eggs, 19·1 by 14·3.

Where these birds go in winter is not known to me.

43. Calliope pectoralis pectoralis. The Himalayan Ruby-throat.

This beautiful bird is quite common on the steep rocky and grassy mountain slopes above the forest level, especially where there is much juniper scrub. They are found on the Pir Panjal as well as on the Himalayan slopes, but are far more numerous on the latter. They are commonest at from 11,000′ to 12,000′. The cock has a fine loud song. Nidification commences in June and eggs are obtainable throughout June and July. Nests are well concealed on the ground, among rocks and grass or in low juniper scrub. The nest is composed of dry grass and is domed, with a large lateral entrance. Four eggs are laid, rather dark bluish-green with pale rufous markings. This species is largely parasitized by the Asiatic Cuckoo. Of five nests found this year one contained a young cuckoo and another a cuckoo's egg.

This species is found on the Ladakh side of the Himalayan Range as well as on the Kashmir side.

Measurements of eggs are as follows :—L., *22·4* × 15·2. S. and N., *19·7* × *15·0*. B., 21·8 × *15·8*. Average of 9 eggs, 21·0 by 15·3.

44. Calliope tschbaiewi. The Tibetan Ruby-throat.

This bird, which resembles the preceding species, but differs from it in having a white cheek stripe, is local and rather rare in Ladakh.

It was only observed by me in one locality, viz. near Ralma, between Shushal and the Indus River, between 14,000′ and 15,000′. Here they were fairly numerous in the wide stretches of thorny furze (caragana) intersected with small streams. In their habits and song they resemble the Himalayan species. Two nests were found at the base of furze bushes both of which contained young (three and two respectively). This was on June 30. Nests were quite similar to those of the Himalyan Ruby-throat.

45. Ianthia cyanura rufilata. The Red-flanked Bush Robin.

This is a very common bird in summer in the silver fir and birch zone in Kashmir between 9,000′ and 11,000′. They are found in the forest, chiefly on northern aspects. They have no song, only a 3-noted call in which the middle note is a tone lower than the first and third. They are shy birds and very wary when their nest is anywhere in the vicinity.

The nest is placed on the ground, generally in a hole in a bank or fallen log. It is nearly always lined with musk deer hair.

The eggs are laid in May and are very pale greenish-white, faintly speckled with rufous. Eggs measure as follows :—L. *18·8* × 13·2. S. and N., *16·9* × *12·9*. B., 17·7 × *14·4*. Average of 9 eggs, 17·9 by 13·7.

I have never seen this species in winter.

46. Adelura cœruleocephala. The Blue-headed Robin.

This bird occurs sparingly on steep, rocky hillsides on the Himalayan Range between 9,000′ and 11,000′. They avoid tree forest, preferring open rocky country. The cock bird is a fine songster. The bird is not common anywhere in Kashmir and so far I have failed to find its nest, but they undoubtedly breed in rocks at about 10,000′.

47. Turdus merula maximus. The Central Asian Black-bird.

This is nowhere a common bird in Kashmir, but is found widely distributed at high elevations above the tree limit between 11,000′ and 13,500′. They prefer open steep rocky country especially where there is thick low cover of dwarf juniper or dwarf rhododendron. The song of the male is very poor and monotonous. They are wild, wary birds, very difficult to approach. They are found equally on the Pir Panjal and Himalayan Ranges. On June 23, I saw a pair with young able to fly on the mountain slope above Gulmarg at 11,000′. Subsequently on July 11, I observed a pair hopping about on the ice on the surface of Sona Sar lake (Lidar Valley) at 12,500′. This was before sunrise, They were busy collecting hymenopterous insects, lying numbed by cold on the ice, and carrying them up to their young concealed up above on a precipitous rocky juniper-covered slope. I have never seen these birds in the Kashmir Valley in winter and they probably do not descend in winter below about 8,000′.

48. Turdus castaneus castaneus. The Grey-headed Thrush.

This is a moderately common bird in the big dense forests of silver fir from about 8,000′ to 10,000′, both on the Pir Panjal and on the Himalayas. They are shy, quiet, unobtrusive birds as a rule. The cock bird is a really fine songster, perhaps the best of the thrush family in India, not excepting *Turdus boulboul*.

They breed in June, the nest being quite low down against a tree stump or rock or even on the ground, Eggs are of the blackbird type but rather richly marked. A nest was found on June 19, in the Lidar Valley in dense fir forest on a large mass of rock, two feet from the ground. It contained three eggs, the average measurements of which are 30·1 by 21·9.

49. Turdus atrogularis. The Black-throated Thrush.

This is only a winter visitor to the Valley of Kashmir where they are moderately common. They may be seen feeding among the willows in and around Srinagar from October to March. They do not breed in Kashmir territory.

50. Turdus unicolor. Tickell's Thrush.

This is one of the commonest birds in the Kashmir Valley in summer. They are restricted to the valley proper, being only found to a limited extent in the side valleys up to about 6,000′ elevation. They frequent orchards and gardens and are especially numerous in and around Srinagar.

They arrive in March, leaving again in October, after the reaping of the apple crop. From the end of March throughout April and May these birds unite in a chorus of song in the very early morning, before dawn and again to a less extent in the evening. The song is rather poor and monotonous as compared with that of the English thrush or blackbird. They are fairly tame and confidential, feeding early and late on grassy lawns and in the autumn on apples (chiefly windfalls).

They breed from early May throughout June. The nest is like that of the English blackbird, but rather less massive. The eggs too, are like small editions of those of the blackbird, but eggs with a marked rufous colouration are commoner than is the case with those of the English blackbird.

The dimensions of eggs are :—L., *28·9*×20·5. S. and N., *25·2*×*18·2*.B., 28·3×*21·1*. The average of 89 eggs is 27·1 by 19·3.

51. Arceuthornis viscivorus bonapartei. The Himalayan Missel Thrush.

This bird is found, but is not very numerous, on the hills in rather open fir and birch forest, at from 9,000′ to 11,000′ both on the Pir Panjal and Himalayan Ranges. They have similar habits and song and a similar alarm call to that of the English missel thrush. Two nests only were observed, one on June 23 at 9,000′ was on the lower branch of a silver fir tree some 6′ from the ground. It contained 3 eggs. A second nest 5′ from the ground in a young silver fir contained 3 young on July 15.

The eggs taken seem rather large and elongate but are similar in colouration to those of the home bird. They average 34·5 by 21·8.

52. Monticola solitaria pandoo. The Indian Blue Rock Thrush.

These birds are migratory, arriving in Kashmir and Ladakh in April and May leaving in the autumn for the plains. They are not uncommon on rocky, precipitous hillsides from 5,500′ to about 15,000′. They frequent open hillsides and do not enter the forest.

The cock bird has a fine song in the spring uttered from the top of a rock as well as on the wing. At this time of the year when courting, the male bird indulges in slow vol-planing flights in the sunshine, thereby exhibiting to the best effect his blue plumage.

Nests are placed in holes and clefts in steep rocky precipitous ground and are generally difficult to reach and not infrequently quite inaccessible. They are made of roots and lined with fine roots. The eggs, four are five in number are either pale spotless blue, or blue with faint pinkish brown specks. They measure :—L., *27·3*×19·7. S. and N., *26·1*×*18·5*. B., 27·0×*20·9*, the average of 14 eggs being 26·7 by 19·7.

53. Monticola cinclorhyncha. The Blue-headed Rock Thrush.

This is not a common bird in Kashmir, but is found widely distributed both on the Pir Panjal and Himalayan slopes in rather open forest between 6,000′ and 9,000′. I have occasionally seen it as high as 10,000′. The song is loud and clear but rather monotonous.

A single nest only was found in the Lidar Valley on a steep bank in forest at 6,500′ containing 3 fresh eggs on June 12, which average 23·7 by 17·9.

54. Myiophoneus temminckii temminckii. The Himalayan Whistling Thrush.

Common in summer, along all big hill streams from about 6,000′ up to 11,000′ and occasionally even higher. In winter they descend to the lower valleys and even to the plains. The song of the bird is fine and loud with considerable variation, but is not to be compared with that of his southern relative in the Central Provinces and Madras. Breeding commences in May and June according to elevation. The nest of moss, lined with roots, is placed in a niche in a rock or boulder often in mid-stream and quite inaccessible, more rarely on a tree.

The eggs, generally 3 in number, are long ovals, pale greenish or cream coloured faintly mottled or freckled with pinkish markings ; they measure as follows :—L., *40·2* × 25·7. S. and B., *34·7* × *27·0*. N., 40·2 × *24·6*. Average of 10 eggs, 36·9 by 25·6.

55. Laiscopus collaris whymperi. The Turkestan Hedge-Sparrow.

This species is found at high elevations in Kashmir in summer, breeding on rocky precipitous ground above the tree limit at altitudes of 12,000′ and upwards. It is also found in Ladakh at even higher elevations.

A pair were seen at 12,500′ above the Gangabal Lake near Hara Mukh Mountain on August 13. They had a brood of well fledged young, fully a month old. Another pair were seen below the Khardong Pass above Leh on July 23 at 16,500′. They were evidently breeding. A third pair was secured in winter on the Takht-i-Suliman (elevation 6,000′) near Srinagar on December 14.

56. Laiscopus himalayanus. The Altai Hedge-Sparrow.

Found occasionally in flocks in the lower hills in Kashmir on the spring migration. Two birds shot from a large flock on the Takht (Srinagar), 5,500′, on March 17. Not seen in summer.

57. Prunella rubeculoides. The Robin Hedge Sparrow.

One of the common birds of Ladakh between 13,000′ and 16,000′ elevation. They are found chiefly in low scrub, the Tibetan furze (caragana, sp.) dwarf willow, etc. and also in stony, rocky ground. They are tame and confiding. The cock bird has rather a sweet, short song. Nidification commences towards the end of May. Nests are composed of dry grass and weed stems, profusely lined with wool or hair, and are placed very low down, almost on the ground, at the base of furze bushes more rarely under stones. Three or four eggs are laid of a uniform pale turqoise blue.

Eggs vary in length from 23·4 to 19·7 and in breadth from 15·7 to 14·9, the average of 41 eggs bring 21·1 by 15·3.

58. Prunella fulvescens fulvescens. The Brown Hedge-Sparrow.

This is a comparatively rare bird in Ladakh. They frequent similar ground to that in which the previous species is found, but fifty of the Robin Hedge Sparrow are seen to every one of this species. Nests are placed in low bushes about 2′ from the ground. Both nest and eggs are similar to those above described, but the few eggs (7) taken average, a little smaller viz., 20·9 by 15·0.

59. Prunella atrogularis. The Black-throated Hedge-Sparrow.

Occasionally seen in the Valley of Kashmir on the spring migration. A bird was shot at Pari Mahal (Srinagar), at 6,000′, on March 14.

60. Prunella strophiata jerdoni. Jerdon's Hedge-Sparrow.

This is a common bird in the silver fir and birch forest from 9,000′ to 11,000′, both on the Himalayan Range and on the Pir Panjal. It has a short, rather pretty song interspersed by occasional harsher notes. Nidification commences early in June. Nests are usually placed in low bushes, also not infrequently in the foliage of the lower branch of a silver fir and sometimes as high as 10′ from the ground.

The nest is composed of sticks, moss and weed stems and is lined with fine grass, hair and feathers.

Three or four eggs, spotless blue, are laid, which vary in length from 19·7 to 17·5 and in breadth from 14·5 to 13·2, the average of 19 eggs being 18·6 by 13·8.

61. Hemichelidon sibirica gulmergi. The Kashmir Sooty Flycatcher.

This is quite the commonest flycatcher in Kashmir. They are found throughout the silver fir and birch forests from about 8,000′ to the limit of tree growth (11,000′). They hawk flies from a fixed perch and are not at all shy. They may be seen feeding near the tops of the highest fir trees as well as close to the ground. The subspecific name of this bird is a happy one, as nowhere is the bird found more numerous than in the vicinity of Gulmarg.

Breeding commences early in June, nests being placed in the leafy portion of silver fir boughs at any height from the ground, from about 7′ upwards, or in birch trees. The nest is a neat compact cup composed of grey lichens and moss consolidated with spiders' web, and lined with fine strips of grass or inner bark with a few hairs or feathers.

Three eggs, more rarely four or only two, are laid of a pale greenish stone colour with a tinge of pale rufous suffused around the broad end of the egg.

Eggs give the following measurements :—L., *15·6* × 11·7. B., 16·1 × *12·8*. S. and N., *15·1* × *11·5*. The average of 11 eggs is 16·0 × 12·1.

62. Siphia parva parva. The European Red-breasted Flycatcher.

This species is fairly common in the Kashmir Valley in the spring and autumn migration and a good many may usually be seen in and around Srinagar in September-October. I have never, however, come across a bird in the breeding season either in Kashmir or in Ladakh.

63. Siphia parva hyperythra. The Indian Red-breasted Flycatcher.

This is a very common species in Kashmir in the summer, breeding in June, in the side valleys, e.g. Sind and Lidar, at from 6,500′ to 7,500′. They are very partial to mixed forest of hazel, walnut, cherry, willow, etc., especially where there is a dense growth of perrottia.

The nest is placed in a hole in a small tree at a height of from 5′ to 20′ from the ground. It is usually invisible from the outside and can only be obtained by enlarging the small entrance hole. It is composed of skeleton leaves, moss, strips of bark, etc., and is lined either with finer strips of bark or with hair.

The eggs 4 or 5 in number are very pale green in ground marked chiefly at the broad end with pale pinkish brown.

They pass through the valley, including Srinagar, in September and early October on their way to Ceylon, where they spend the winter.

Eggs measure as follows :—L., *17·9*×13·0. B., 17·5×*13·1*. S., and N., *15·4*×*12·4*. Average of 36 eggs, 16·6×12·5.

64. Cyornis superciliaris superciliaris. The White-browed Blue-Flycatcher.

This bird, so common in the hill forests in Garhwal and Kumaon, is not very common in Kashmir. It is found in the mixed forests of blue pine, silver fir and broad-leafed species at from about 6,300′ to 9,000′, and here they breed.

The nest is usually in a hole or rift in the trunk of a tree from 10′ to 20′ from the ground. It is composed of moss and dry grass and is lined with fine strips of bast and a little hair.

The eggs, 3 to 5 in number, are similar to those of *Siphia parva* described above, but the markings are less distinct in this species than is the case with eggs of *Siphia*.

Eggs measure (average) 15·1 by 11·9.

65. Cyornis tricolor tricolor. The Slaty-blue Flycatcher.

This is a very common bird in the silver fir forests of Kashmir breeding from about 8,000′ to 10,000′ in June and July. The cock has a pretty little short song, not often heard. This species frequents the undergrowth and lower branches of trees in the forest. The nest is placed in a shallow hole or rift in the bark of a tree generally well within each of the hand. The alarm call of the bird is 'Ee-tick.' Nests are composed of fine moss consolidated with cobwebs and lined with still finer moss and a little hair. Four or three eggs are laid which are a beautiful pale buff with a pale rufous cap or ring at the broad end. They measure :—L., *16·4* × 12 1. S., *13·9* × 11·4. B., 16·2 × *12·5*. N., 13·9×*11·4*. Average of 52 eggs, 15·6 by 12·1.

66. Alseonax ruficaudus. The Rufous-tailed Flycatcher.

This species is not uncommon in Kashmir both on the Himalayan and Pir Panjal Ranges in mixed as well as silver fir forest from 7,000′ up to 9,000′.

They are restless little birds wandering about in the crowns of trees, from tree to tree, the male giving utterance to his short rather loud song of three or four notes only, repeated at short intervals. They are solitary in their habits and resemble arboreal chats rather than typical flycatchers. The nest resembles that of *Hemichelidon sibirica* described above, and is placed on a side branch of a silver fir or other tree generally over 20′ from the ground.

The nest is a very difficult one to find as the cock bird feeds at a considerable distance from the nest which he very rarely visits.

The eggs, usually 3 in number, are laid in June or July and are similar in colour to those of *Siphia*, being very pale greenish in ground, freckled with pale rufous chiefly at the broad end. The average of 3 eggs is 17·5 by 13·9.

67. Culicicapa ceylonensis ceylonensis. The Grey-headed Flycatcher.

This bird was not met with in the Kashmir Valley. A single bird was seen near Domel in the Jhelum Valley at about 2,000′. This was on October 31.

The call-note of this bird is so loud and characteristic that it would be impossible to overlook its presence, and it is certainly very rare in Kashmir.

68. Terpsiphone paradisi leucogaster. The Himalayan Paradise Flycatcher.

This beautiful bird is common in the Valley of Kashmir during the summer months, ascending the hills and side valleys up to about 6,000′ only

They begin to arrive about the middle of April and they have all gone by the middle of October. They have a rather pretty song of a few notes, quite distinct from the harsh call note.

They breed in May and June, nests being constructed chiefly in willows and Chenar trees, at various heights from the ground. Four or three eggs are laid, the ground colour of which is creamy or pinkish white with spots of bright reddish brown. They measure as follows:—L., *22·1*×15·5. S., *19·4*×16·0. B., 19·5×*16·1* N., 20·9×*14·7*. Average of 10 eggs, 20·8 by 15·4.

69. Lanuis vittatus. The Bay-backed Shrike.

This species appears to be only a very rare and occasional visitor to the Kashmir Valley. A single bird was observed in Srinagar in May. It is probably not rare in Jammu.

70. Lanius schach erythronotus. The Rufous-backed Shrike.

This is quite one of the commonest birds of the Kashmir Valley, extending up the side valleys to about 7,000′ and occasionally higher. A pair was observed in Kargil (Ladakh) at 8,900′ which were breeding there. They are summer visitors to Kashmir arriving in April and leaving in September-October.

This species is an extraordinary good mimic and it may be heard repeating the notes of many and various birds in rapid succession and the reproductions are so perfect as frequently to mislead one into imagining that the bird mimicked is actually there. Perfect imitations of the following birds' notes have been heard produced by this shrike:—Common kite, myna, sparrow, swallow, swift, paroquet, red-vented bulbul, common babbler, red-wattled lapwing, black partridge, common sandpiper, jungle babbler, and green bee-eater.

Breeding commences in May. Nests are rather bulky cups of twigs, grass, bark and roots, etc., lined with roots, and a little wool or hair. They are placed at various heights from 6′ upwards in fruit trees (apples, pears, quinces etc.) willows, poplars, etc. Five is the usual full complement of eggs laid, sometimes only four and less frequently six may be found. They vary a good deal in colour, shape and size but the majority are dull white in ground, fairly heavily marked with sepia or dark grey or yellowish brown in a zone at the big end. Erythristic varieties are rather rare. Measurements of eggs are as follows:—L., *25·6*×18. S., *21·5*×*16·4*. B., 22·1×*19·0*. Average of 95 eggs, 23·0 by 17·9.

71. Lanius cristatus isabellinus. The Pale Brown Shrike.

This bird is not found in Kashmir proper, but occurs in Ladakh, where however it is rare. Two specimens only were observed in May and June in the Indus Valley between 11,000′ and 12,000′. It probably breeds in this locality.

72. Pericrocotus brevirostris brevirostris. The Indian Short-billed Minivet.

Fairly common up the side valleys and on the lower well-wooded slopes of the Himalayas, and Pir Panjal, in summer between 6,000′ and 8,500′ : in winter lower. They breed chiefly between 7,000′ and 8,000′ in the blue pine forest. The nest is usually in a blue pine, often between 50′ and 80′ from the ground. Many nests of this bird are destroyed by the jungle crow.

73. Dicrurus leucophæus longicaudatus. The Indian Grey Drongo.

Widely distributed but not very common in Kashmir, it is found in summer in the main and side valleys up to about 6,000′. Nests were observed in June, under construction, in chenar trees.

Eggs are 4 or only 3 in number, pinkish white marked with dark red brown. They average 5 eggs, 23·2 by 17·9.

74. Acrocephalus stentoreus brunnescens. The Indian Great Reed-Warbler.

Very common in the big jhils and lakes in the valley wherever there is a dense growth of the big bulrushes. They are particularly numerous in the Dal Lake close to Srinagar, arriving in April and disappearing towards the end of September.

They are extremely noisy birds, their harsh notes being constantly heard in the dense beds of rushes in May and June.

Nests are woven into 3 or 4 rush stems 2′ or so above the water and 3 or 4 eggs are laid, which are white, more or less heavily marked all over with different shades of brown, grey and sepia. They measure :—L., *24·0* × 16·2. S. and N., *21·0* × *15·4*. B., 23·3 × *17·1*. Average (29 eggs), 22·6 by 15·8.

75. Acrocephalus concinens concinens. The Chinese Paddy-field Warbler.

This is a common bird in the swamps of the Kashmir Valley, frequenting chiefly grassy, marshy swamps and avoiding the beds of bulrushes over water which are the home of the previous species.

They are not very shy, and the cock has rather a pretty little short song which has none of the harsh notes of the song of the Great Reed-Warbler.

Contrary to the statement in the *Fauna of British India* (Birds), revised edition, this bird breeds in swamps and not on hillsides far from water. The nests are placed generally rather low down in the long dense grass found in swampy ground. The nest is woven into several blades or stems of grass and consists of dry grass, dry rush leaves and occasionally some moss neatly woven together with a little animal wool or vegetable cotton, lined with fine flowering grass stems and in one case with red moss fruiting stems. Most nests are within a foot of the wet ground, but one was 2′ 6″ up.

Eggs are rather broad ovals, without gloss, fair miniatures of those of the Great Reed-Warbler. Ground very pale green, almost pure white spotted yellowish-brown and pale purplish-grey, more or less all over, but chiefly at the broad end. There are also sometimes a black streak or two.

Eggs measure :—L., *18·3* × 12·9. S., *15·7* × 12·7. B., 17·7 × *13·2*. N., 17·8×12·2. Average of 47 eggs, 17·1 by 12·7.

76. Tribura major.—The Large-billed Bush-Warbler.

This is a fairly common bird in suitable places between 8,000′ and 12,000′ both in Kashmir and in Ladakh. Irrigated grass lands, cultivated fields and low thorny scrub (*Lonicera spinosa*), interspersed with grass, are its favourite haunts. It is a great skulker. Its call is persistent and monotonous, resembling the syllables ' chipi-chipi-chipi ' repeated indefinitely at the rate of about 3 to a second, generally from the topmost twig of some bush or small tree.

The nest is a deep cup of grass placed on or very near the ground concealed in grass at the base of some low thorny scrub. It is a most difficult nest to discover, as the location of the nest is not as a rule given away by the parent bird when leaving the nest, owing to the fact that she usually runs like a rat for some distance through the grass, on leaving the nest, before taking flight.

Egg-laying commences in the end of June or early July. Three or four eggs is the usual full complement, but 2 and even 1 hard set eggs were found.

Eggs are pale pinkish in ground spotted all over but specially at the broad end with bright terra cotta markings and a few faint grey underlying markings as well as occasionally very thin black lines. Eggs give the following measurements :—L., *20·6* × 14·8. S. and N., *17·4* × *13·3*. B., 18·5 × *15·0*. Average (34 eggs), 18·9 by 14·3.

77. Sylvia curruca affinis.—Indian Lesser White-throat.

This White-throat is common in the main and side valleys of Kashmir on stony bush-covered hillsides at from 5,000′ to about 7,000′. It is also fairly common in Ladakh in the Indus, Shyok, Nubra, Dras and Suru Valleys at from 9,000′ to 12,000.′ In Kashmir they frequent low scrub consisting of *Berberis*, *Rubus*, *Cotoneaster*, and wild briar, and in Ladakh the thorny patches of *Lonicera spinosa*.

It is however very strange that this bird is found breeding in Kashmir between 5,000′ and 7,000′ and in Ladakh between 9,000′ and 12,000′.

Nests are of fine dry grass and weed stems, thin and almost transparent, placed in thorn bushes especially *Berberis* and *Lonicera spinosa* about a couple of feet from the ground—more rarely nests are built on the lower branches of trees, e.g., the blue pine and are then 8′ or 10′ from the ground.

Eggs are usually 4, sometimes 3, in number. Kashmir eggs are on the average a little smaller than Ladakh eggs as is shown by the following figures :—

	Ladakh. 9,000′ to 12,000′.	*Kashmir.* 5,000′ to 7,000′
Longest	*19·8* × 14·1.	*19·0* × 13·1.
Shortest	*17·2* × 13·5.	*15·6* × 12·0.
Broadest	17·6 × *14·4*.	17·3 × *14·0*.
Narrowest	17·8 × *18·0*.	15·6 × *12·0*.
Average	(41 eggs), 18·5 × 13·7.	(86 eggs), 17·5 × 13·0

This looks very much as if the Ladakh and Kashmir White-throats were incipient species or subspecies.

The song of this white-throat is bright—with occasional harsh notes, and on the whole the effect is pleasing.

78. Phylloscopus affinis. Tickell's Willow-Warbler.

This little warbler is exceedingly common at high elevations, above the tree limit, both in Kashmir and Ladakh. It is found breeding in the low scrub *Caragana* and *Berberis*, in Ladakh—juniper, dwarf rhododendron, dwarf willow and berberis in Kashmir at from 10,500′ to 16,000′. No other bird approaching this one in smallness is found at these high altitudes, at any rate in Ladakh, and it is indeed strange how such minute birds can survive the low temperatures experienced regularly at night and occasionally also during blizzards, by day.

Nests are of dry grass, domed and copiously lined with feathers, placed in the low thorny scrub from 1′ to 2′ from the ground. The eggs, four in number, are either pure white or white scantily spotted with pale rufous. These two varieties of eggs are about equally common and both are sometimes found in the same nest or all the eggs in a clutch may be of one kind. Eggs measure as follows :—Length, from 17·1 to 13·0. Breadth, from 14·2 to 11·6. Average (43 eggs), 16·2 by 12·3.

79. Phylloscopus tytleri. Tytler's Willow Warbler.

This species is found in the silver fir forests of Kashmir between about 8,000′ and 10,000′, especially where there are small sunny openings in such forest with shrubby undergrowth of viburnum, etc.

It is not generally a very common bird and I found it rather scarce on the Himalayan Range, but is much commoner on the Pir Panjal above Gulmarg.

The note or song of this species, if it can be called a song, resembles the words ' Let's kiss him ' repeated at frequent intervals.

This species feeds a good deal in the forest undergrowth near the ground.

Nidification commences early in June. Nests are small and globular, resembling those of *P. proregulus* and are constructed of lichens, moss, etc., and lined with feathers. They are well concealed in the leafy boughs of silver firs, generally at some considerable height above the ground (it is rare to find a nest within 20′ of the ground). The writer never succeeded in finding the eggs.

Photo R. E. Holmes, Peshawar

ON THE DAL LAKE

Photo R. E. Holmes, Peshawar

IN CAMP—SIND VALLEY

80. Phylloscopus collybitus sindianus. The Sind Chiff-Chaff.

This species is found in the Kashmir Valley on the spring aud autumn migrations i.e. during April and October. During the summer months they are found in Ladakh where they breed in large numbers between 10,000′ and 14,000′.

They are found between these limits wherever there are willows and low scrub (either or both). The song of the bird is very like, if not identical with, that of the English Chiff-Chaff, and is just as persistent.

Breeding commences in the third week of May. Nests are domed with a fairly large lateral entrance, of grass and weedstems, lined first with a layer of *very* fine vegetable down—and then with feathers—more rarely with willow cotton and no feathers.

Eggs are four—very rarely five—in numbers white spotted chiefly at the large end with chestnut spots and specks.

The nest is usually placed in low thorny scrub but not infrequently also in the cut thorns which are placed in and near villages on the tops of stone walls and buildings. Where no low thorny scrub exists as in the Puga Valley, many nests were observed in large shrubs of *Myricaria elegans*, several feet from the ground and in one case in a willow 10′ up. Eggs measure as follows :—L., *1·70* × 12·0. B., 16·2 × *12·5*. S., *14·1* × 11·4. N., 13·5 × *10·4*. Average (140 eggs), 15·8 × 12·0.

81. Phylloscopus collybitus tristis. The Brown Chiff-Chaff.

This race is found in the Kashmir Valley on migration.

82. Phylloscopus griseolus. The Olivaceous Tree-Warbler.

This bird was observed in April and early May on the Takht-i-Suliman, Srinagar, at 5,500′, climbing about on mossy rocks. It is also not uncommon in the Indus Valley near Leh in summer, where it was watched climbing about on the trunks of willow trees.

83. Phylloscopus humii humii. Hume's Willow-Warbler.

This is one of the commonest of the willow-warblers in Kashmir. In the summer it is found throughout the silver fir forest, more especially near the outskirts or in sunny blanks or glades. Its common call note is ' Tissip.' The nest is domed and lined with fine grass, pine needles and a little hair. It is placed on the ground, usually on a steep bank, in a situation such as might be chosen by the English Willow-Warbler. Four eggs—rarely five—are laid, white well spotted with reddish brown.

They measure :—L., *15·6* × 11·7. S., *12·1* × 10·5. B., 15·5 × *11·9*. N., 13·5 × *10·4*. Average (50 eggs), 14·0 by 10·9.

84. Phylloscopus proregulus simlaensis. Ticehurst's Willow-Warbler.

This bird is widely distributed, but not very common, in the fir forests of Kashmir between 7,500′ and 10,000′. Nests were found on low silver fir branches above Pahlgam at 7,500′ and above Gulmarg at 9,000′ in early July. Eggs were on the point of hatching.

85. Acanthopneuste magnirostris. The Large-billed Willow-Warbler.

This species which is nowhere very numerous, is at the same time not rare and is widely distributed throughout Kashmir. It is found in the summer in practically every well-wooded ravine provided there is also a stream or torrent, between 6,000′ and 10,000′.

The call of the bird is remarkable and characteristic, consisting of five notes, with a drop from the first to the second and third, which are the same note, and a further drop from the third to the fourth and fifth which are again the same note, but lower than the second and third. The birds spend most of their time in the crowns of trees.

Breeding commences towards the end of June. Nests are roughly domed, of grass, moss, dead leaves and maidenhair fern, lined with fine grass flowering stems and are placed in a hole or crevice in a fallen log or tree or rock often overhanging a stream.

Eggs, four or three in number, are pure white and very fragile.

They measure :—L., *19·4* × 13·9. S. and B., *17·9* × *14·1*. N., 18·4 × *13·1*. Average (9 eggs), 18·5 by 13·6.

86. Acanthopneuste occipitalis occipitalis. The Large Crowned Willow-Warbler.

This is perhaps the commonest of all the Willow-Warblers in Kashmir, being found throughout the mixed forest, Fir forest and Fir mixed with Birch, from 6,000′, up to the limit of tree growth at 10,500′ or even higer. The alarm call of these birds resembles the word 'Chick-Wee.' The song of seven notes is high pitched and monotonous—repeated all day and every day from the crowns of the silver fir trees and resembles the syllables Tee—Tsee tsee—Tsee tsee—Tsee tsee.

Nesting commences in June. Nests are composed of moss, with an attempt at a dome, and are either unlined or lined with a little hair.

The eggs, four in number, are pure white and fragile, measuring :—L., *17·5* × 12·5. B., 15·9 × 13·0. S., *15·1* × 12·1. N., 15·9 × 11·5. Average, 36 eggs, 16·0 by 12·3.

87. Seicercus xanthoschistus albosuperciliaris. The Kashmir Grey-headed Warbler.

This bird, in spite of its name, is not at all common in any part of Kashmir with which the writer is acquainted. It was observed in early spring at about 6,500′ both in the Sind and Dachigam valleys. It doubtless breeds in both these localities.

88. Horornis pallidus pallidus. The Pale Bush-Warbler.

This is a common bird in Kashmir, frequenting the lower and middle slopes of the main and side valleys in summer between 5,500′ and 8,000′. They frequent bush-covered hill slopes, avoiding tree forest, and they are apt skulkers.

The call of this bird is remarkably loud and very peculiar. It consists of two 'phrases.' The first, consisting of five notes, commences with a long drawn-out whistle. The second of three notes also commences with a long-drawn note, in a minor key. The two parts or phrases may be expressed by the words

You.......................... mixed-it-so-quick.
He'll........................ beat you.

The first words 'you' and 'he'll' being drawn out to nearly two seconds in length each.

The nest is rather untidy, domed, with a large side entrance, composed of dry grass and lined with feathers. It is placed low down in a bush or bramble or in a tuft of long dead grass.

The eggs, 3 or 4 in number, are deep chocolate or purple-brown and measure :—L., *18·3* × 13·5. B., 17·7 × *13·8*. S., *16·4* × 13·0. N., 16·4 × *12·0*. Average, 26 eggs, 17·5 by 13·2.

In winter this bird descends to the foot-hills and is even found commonly at that season on the bush-covered slopes along the Soan and Leh Rivers, near Rawalpindi.

89. Regulus regulus himalayensis. The Himalayan Gold-Crest.

Not very common but generally distributed in the Silver fir forests at from 9,000′ to 10,000′. Seen near Gulmarg—also up Lidar Valley above Tanin.

90. Cephalopyrus flammiceps. The Fire-capped Tit-Warbler.

Not uncommon in mixed forest of hazel, elm, walnut, etc., just below the silver fir zone in June and July. Also seen early in August at 11,500′ in the Lidar Valley near Astormarg, feeding in the dwarf willows.

91. Oriolus oriolus kundoo. The Indian Oriole.

Very common in the Kashmir Valley throughout the summer, arriving in April and leaving towards end of September. They are specially numerous in and around Srinagar. Their fine flute-like notes may be heard in chorus every morning in May at dawn, together with the song of *Turdus unicolor.*

They ascend the side valleys to about 7,000′ only. They are also found in the Indus Valley in Ladakh even as high as Leh at 11,500′, but here they are somewhat rare.

They breed in June and July the nest being woven cradle-like into branches of the Chenar, fruit trees and willows.

The eggs, usually three in number, more rarely four or only two, are white with a few very dark reddish-brown spots in which the colour often seems to 'run' into the white ground. They measure :—L., *32·5* × 20·7. B., 31·0 × *21·4*. S., *23·6* × 19·7. N., 26·5 × *18·9*. Average (17 eggs), 29·3 by 20·3.

92. Sturnus vulgaris humii. The Kashmir Starling.

Exceedingly common in the Valley of Kashmir, but not found to any extent up the side valleys or on the surrounding hills. They arrive in the last week in February and early March and leave in October. The F.B.I. says this species is also found in Garhwal and Nepal. I very much doubt this and believe that this starling is not found in the Himalayas south or east of Kashmir except as a rare straggler.

Breeding commences in May, nests being built of grass and lined with feathers in holes in trees (willows, chenars, mulberries, etc.) as well as in banks and in houses. Five, and rarely six eggs are laid which are uniform very pale blue in colour. They measure :—L., *30·7* × 20·9. B., 26·6 × *2·16*. S., *26·4* × 19·8. N., 27·7 × *19·2*. Average, 92 eggs, 28·8 by 20·7.

93. Acridotheres tristis tristis. The Common Myna.

Common in the Valley of Kashmir, especially in and around Srinagar and in all the big villages. Extending up the larger side valleys to about 7,000′.

They are resident in Kashmir throughout the year.

Breeding commences in May, nests being placed in holes in buildings, in trees and in steep banks.

Five eggs are laid which are of a deeper blue than those of the Starling.

They measure :—L., *34·6* × 22·8. B., 33·9 × *23·0* S., *29·7* × 21·2. N., 32·3 × *20·5*. Average, (15 eggs), 32·3 by 21·9.

94. Cinclus cinclus kashmiriensis. The White-breasted Asiatic Dipper.

This species is not rare on the mountain streams and torrents descending from the Himalayan Range especially at elevations above 10,000′, near the snow beds and glaciers. It is still commoner in Ladakh from 11,000′ up to at least 16,000′. They seem to prefer clear, swift-flowing torrents interspersed with stones and boulders and they are constantly plunging into the ice cold water remaining below often for ½ a minute, in search of food. They have a bright rather loud song, heard chiefly in May and June.

They breed from May to July according to elevation, the nest being a large oven-shaped mass of moss lined with fine dry grass, which is placed in a crevice in a rock or hole in a bank overhanging swift flowing water. Three or four eggs are laid long pyriform ovals, pure white, varying in length from 27·2 to 25·0 and in breadth from 19·2 to 18·4. Average of 8 eggs, 26·1 by 18·8.

95. Cinclus pallasii tenuirostris. The Brown Dipper.

This is much commoner than the last in Kashmir, but is found at lower elevations, chiefly from 3,000′ up to 9,000′ and occasionally higher. In their habits, they resemble the White-breasted Dipper. They are very early breeders, commencing in February and continuing on till May. Nests and eggs resemble those of the last species. Eggs measure about 25·4 by 18·3.

96. Perrisospiza icteroides icteroides. The Black-and-Yellow Grosbeak.

Fairly common in the silver fir and mixed forests on the Himalayan slopes, as well as on the Pir Panjal from 8,000′ to 10,000′. They are found only in high forest. They feed largely on the fruits of shrubs and undergrowth in these forests. They have no song, only a call of three clear notes, uttered at frequent intervals. They construct their nests high up in fir trees, in June.

97. Pyrrhula aurantiaca. The Orange Bullfinch.

This handsome bird is a resident species in Kashmir being found in the lower mixed forest, in the side valleys, in winter at from 5,500′ to 6,500′ and in summer between 9,000′ and 11,000′. They are not very common anywhere, and are rather solitary, quiet, unobtrusive birds, their presence being usually first detected by their soft, clear, low call note.

In the breeding season they are to be found in openings in the silver fir and birch forest, especially where there is plenty of young tree growth and herbaceous weeds.

They commence building early in July. Nests are usually in silver fir or yew trees, either in a patch of young trees or on the lower branch of a big tree.

A nest found on August 4 at 9,000′ in the Lidar Valley exactly resembled that of the English bullfinch being composed of thin twigs and sticks and lined with fine roots. The young had just left the nest, which was placed on the horizontal branch of a silver fir sapling, sheltered above by a second branch and four feet from the ground. It was in a thick patch of similar young trees.

A few days later in another locality in open silver fir forest at the same altitude a young bird was observed only just able to fly. All the birds seen were in the fir or birch and fir forest and they certainly do not breed above the forest limit. I saw no bulfinches on the Pir Panjal Range.

98. Pyrrhospiza punicea humii. The Western Red-breasted Rose-Finch.

This large Rose-finch is widely distributed, but not common, at high elevations both on the Himalayan and Pir Panjal Ranges. They are always found well above the limit of tree growth generally between 12,000′ and 16,000′, they frequent steep, rocky ground near or above the snow line.

They undoubtedly breed in such rocky ground but no nests were discovered.

99. Propasser thurus blythi. The Kashmir White-browed Rose-Finch.

This Rose-finch is found in summer above the tree limit from about 10,500′ to 12,000′ elevation. They frequent the large dense patches of dwarf juniper so common at these altitudes. They are usually met with in pairs and are not common or numerous anywhere.

The call of this bird consists of a rather loud harsh whistle repeated from 6 to 8 times, somewhat reminiscent of the call note of the White-faced Nuthatch. These birds were met with towards the head of the Lidar and Wardwan Valleys. They were evidently about to breed when seen, early in August, and they undoubtedly nest in the dwarf juniper but no nests were found. It is probable they breed about the third week in August.

100. Propasser rhodochrous. The Pink-browed Rose-Finch.

This bird is found generally distributed both on the Himalayas and Pir Panjal at from 9,500′ to about 11,500′. They are decidedly more numerous than the previous species. They frequent open fir and birch forests as well as Willow bushes and dwarf Juniper. Nidification commences in the third week of July and fresh eggs are obtainable till the middle of August.

Nests are built in low bushes, willow, *Lonicera*, etc., as well as in small fir trees and are usually from 2′ to 4′ from the ground. They are of rather solid construction, composed of fine twigs, birch paper and moss followed by fine weed and grass stems and lined with hair.

The eggs 5 or 6 in number are rather deep greenish-blue scantily spotted at the broad end with black spots. Occasionally the eggs are spotless blue.

They measure :—L., *19·6* × 14·5. B. 19·2 × *14·6*. S. *17·4* × 13·9. N. 17·6 × *13·7*. Average 12 eggs, 18·5 by 14·1.

This species was not met with in Ladakh or in Suru.

101. Carpodacus erythrinus roseatus. Hodgson's Rose-Finch.

This is by far the commonest Rose-finch both in Ladakh and in Kashmir, but especially in Ladakh where it is exceedingly numerous wherever there is bush cover between 9,000′ and 12,000′.

These birds pass through Kashmir on their way to their breeding haunts in the higher mountains in the end of May and in June. They were first seen in the Indus Valley on the 1st June.

Nidification commences in the first week of June and fresh eggs are obtainable from about the middle of June to the end of July. Nests are composed of dry grass and weed stems, lined with fine roots or hair or with both. They are placed in low bushes, in Ladakh mostly in *Lonicera spinosa*—also in wild briar and dwarf willow. They are generally from 1′ to 3′ from the ground but occasionally as high as 7′.

The eggs are usually four, very rarely five in number. They are generally rather long ovals, inclined to be pyriform, of a beautiful blue, spotted chiefly at the broad end, with spots or streaks of black or red brown.

It is not uncommon to find a clutch spotless blue or with very minute specks, The song, during the breeding season, is a bright, cheery refrain of from 5 to 8 notes, repeated at intervals by the cock bird, usually from a tree or bush not far from the nest. Each individual has his own particular combination of notes, which is invariable, and this is often shared by the other birds in his immediate vicinity, but in different localities there is considerable variation. These different songs do not, however, differ in character and are always easily recognizable as belonging to this finch.

The vast majority of these birds retire to breed beyond the Himalayan Range into Ladakh (including the Dras and Suru Valleys) and comparatively few breed in the Kashmir side of this range towards the head of the Sind, Lidar and Wardwan Valleys.

Eggs measure as follows :—L., *23·1* × 15·3. B. 21·4 × *15·8*. S., *18·8* × 15·2. N., 20·0 × *13·6*. Average of 202 eggs, 20·8 by 14·9.

102. Carpodacus rubicilla severtzovi. Severtzov's Rose-Finch.

A few birds of this species were seen and specimens secured, in the first week of June in the Indus Valley near Upshi at 11,000′ and again a few days later in the Gya Valley at 12,000′. They were seen in bare rocky ground. They were not seen subsequently and it is not known if they breed in Ladakh or not.

103. Carpodacus rubicilloides. This species, very similar to the last, differs from it chiefly in that the back is streaked with brown and not uniformly grey as in the former.

It is a very common bird in the breeding season throughout Eastern and Southern Ladakh. They are found between 12,500′ and 15,000′ wherever Tama bushes (caragana sp.) or any other shrubs are found.

They were found common near the Tsomoriri Lake and near Puga in Rupshu towards the end of June. They were then building. At Shushal (14,200′) and all along the southern border of the Pangong Lake they were breeding in large numbers early in July.

The song of the bird, if song it can be called, is very poor—consisting of two notes only, the first higher in the scale than the second. The song may be syllabified as follows :—

Tsee-soo-soo-soo or Tsee-Tsee-soo-soo-soo-soo. The alarm call is a loud ' Twink ' like that of the English chaffinch.

The nest is a large massive cup composed of sticks and twigs followed by a layer of dry grass, and lastly a lining of wool and hair.

The full complement of eggs is usually 5 but 4 and even 3 incubated eggs may be found. They are a rather deep blue, sparingly marked with a few large black spots.

The eggs vary in length from 27·2 to 22·2 and in breadth from 19·0 to 16·2. The average of 90 eggs is 24·1 by 17·6.

104. Carduelis caniceps caniceps. The Himalayan Goldfinch.

This a very common bird in Kashmir, and is a resident species In the winter months they are seen in larger or smaller flocks in the valley, and are then common around the base of the Takht near Srinagar. They do not, however, all remain in Kashmir in winter as they are also met with in the plains below the foothills as far out as Rawalpindi where however they are not common.

By the end of February they begin to sing, often in chorus, and towards the end of May they begin nesting in blue pine trees as well as in small trees and large shrubs on the lower hills between 5,500′ and 7,000′.

After rearing the first brood at this comparatively low altitude they leave early in July for higher altitudes and have second nests at from 9,500′ to 11,000′, nesting in blue pine, willows and birches. Second nests are to be found during July and August in the high country on both sides of the Himalayan Range, including the Dras and Suru Valleys and also in the Indus Valley in Ladakh proper.

The song of the Himalayan goldfinch is of a high order and resembles that of the European goldfinch.

The nest also resembles that of its western relation being a beautiful neat little cup composed of fine vegetable materials compactly woven together and lined with fine vegetable cotton, chiefly willow down, with a little hair. The nest is placed in a tree or bush at heights of from 6′ to 60′ or 70′, The eggs, five or four in number, are pale skim-milk blue marked in various ways but never very heavily with spots or streaks of reddish-brown or greyish-brown. Sometimes the eggs are without markings.

Egg measurements are as follows :—L., *19·6* × 13·5. B., 19·0 × *14·0*. S., *16·4* × 12·9. N., 17·3 × *12·7*. Average (38 eggs) 18·0 by 13·2.

105. Callacanthis burtoni. The Red-browed Finch.

This is a common bird in the silver fir forests of Kashmir both on the Himalayan and Pir Panjal Ranges. In the summer they are found at from 8,500′ to 10,000′. They are tame and confiding birds and may be watched at very close quarters. They feed chiefly on ground, from which snow has recently melted, or on low shrubs, the undergrowth in the Fir forests. They are essentially birds of the forest, being rarely seen in the open.

They undoubtedly breed in the fir forest but no nests were found in spite of much search. They are, it is believed, early breeders as young birds, strong in the wing were seen early in June near Gulmarg. The bird has no song, only a call note something resembling that of the bullfinch.

106. Acanthis flavirostris ladacensis. The Ladakh Twite.

This species is exceedingly common in Central, Southern and Eastern Ladakh at elevations of from 13,500′ to 16,000′, where they breed. They frequent areas of Tama scrub, the Tibetan furze (*Caragana sp.*).

They were first observed in Rupshu near the Tsokar Lake at 15,000′ in the first week in June. They had not then commenced breeding. At Puga, (14,000′) around Shushal (14,200′) and along the Pangong Lake (14,000′) they were found breeding early in July. Nests were composed of fine dry grass, lined with hair and were usually placed in low Tama bushes a foot or two above the ground. One nest was found actually on the ground, and others in dwarf willow, several feet up, a single nest being 12′ from the ground.

Four and very rarely 5 eggs are laid which are very pale skim-milk blue in ground, marked chiefly in a zone at the broad end with pink, pinkish purple or reddish brown spots and with sometimes a few streaks of very dark brown.

The eggs vary in length from 19·3 to 16·3 and in breadth from 14·1 to 12·9, the average of 46 eggs being 18·0 by 13·2.

107. Metaponia pusilla. The Gold-fronted Finch.

This is a very common bird in Western Ladakh (the Dras and Suru Valleys) less common in the Indus valley. They are also found in Kashmir proper especially in the spring and autumn, but they appear to retire for breeding purposes to the dry rainless country beyond the Himalayan Range.

The cock bird has rather a sweet little song, not often heard.

Breeding commences in the end of June and fresh eggs are obtainable throughout July well on into August. Nests resemble those of the goldfinch but are not quite so neat or compact. They seem to be invariably lined with fine willow down. Five or 4 eggs are laid, very pale blue or white in ground marked chiefly at the broad end with pinkish-brown or claret some dark spots and some light. Spotless eggs also occur.

Nests are placed almost always in low bushes of the wild rose, from 2′ to 4′ from the ground, less frequently in willow bushes or trees 5′ to 7′ from the ground. One nest was observed in a cleft in a steep rocky cliff 7′ up, and another in an umbelliferous plant growing out of a cliff, but these were exceptional nesting sites. Eggs measure as follows :— L., *18·6* × 12·8 B., 16·5 × *13·3*. S., *15·0* × 12·4. N., 15·0 × *12·4*. Average of 85 eggs, 16·7 by 12·6.

108. Hypacanthis spinoides spinoides. The Himalayan Greenfinch.

This is a fairly common bird in summer at moderate elevations in Kashmir, both on the Himalayan and Pir Panjal Ranges.

They frequent the more open portions of mixed forest, both pine, and fir, chiefly between 6,500′ and 8,000′, but they are also found higher, occasionally up to 11,000′.

The male has a pretty little song. The call note much resembles that of the goldfinch. Breeding commences in July and continues throughout August into September. Nests are placed rather high up in fir or pine trees.

109. Passer domesticus parkini. The Kashmir House-Sparrow.

This is an exceedingly common bird throughout Kashmir and Ladakh.

In Kashmir it is a resident species, found throughout the main valley and up the side valleys to about 7,000′. On crossing the Zoji La into Ladakh the bird is found at much higher elevations, viz. from 9,000′ up to 15,000′ wherever there is permanent cultivation.

The number of birds in Ladakh as well as in Kashmir, in the vicinity of villages and cultivation is almost incredible, and it is probable that many migrate to the plains in winter, but a very substantial residue are permanent residents in Kashmir as well as in Leh (Ladakh).

Breeding commences in Kashmir early in May and in Ladakh fully a month later. Nests are the usual untidy domed affairs, of dry grass lined with hair and feathers.

Four, 5 or 6 eggs are laid which vary considerably in colour but resemble generally those of the European house-sparrow. As is the case with the latter bird, one egg in each clutch is usually much lighter in colour than the rest, with more decided and less blotchy markings.

Eggs measure as follows :—L., *23·5* × 15·7. B., 20·9 × *15·9*. S., *20·2* × 15·4. N., 20·5 × *14·8* Average (78 eggs), 21·7 by 15·4.

110. Passer rutilans debilis. The Kashmir Cinnamon Sparrow.

Common near villages and cultivation in Kashmir from about 6,000′ to 9,000′. It is more of a forest sparrow than *P. domesticus parkini* and where these two species overlap, as at Pahlgam, 7,000′ in the Lidar Valley the House-Sparrow is found in the village and the Cinnamon Sparrow in the outskirts of the neighbouring forest.

It is a common bird in and around Gulmarg and here the House-Sparrow is not found. The Cinnamon Sparrow does not cross the Himalayan Range and is not found in Ladakh.

Breeding commences in June, nests being placed usually in holes in trees at various heights from the ground up to 30′ also in houses, under the eaves, as in Gulmarg. The nest is composed of dry grass and is lined with hair and feathers.

Four or 5 eggs are laid smaller and more darkly marked than the eggs of the house-sparrow but as with that bird one egg is usually much lighter in colour than the rest.

Eggs measure :—L., *21·0*×14·0. B., 19·2×*14·5*. S., *17·4*×13·1. N., 17·4×*13·1*. Average (40 eggs), 19·1 by 13·9.

111. Montifringilla nivalis adamsi. Adam's Mountain-Finch.

This Finch is fairly common in Central, Southern and Eastern Ladakh between about 12,500′ and the snow line. It is not found in West Ladakh (the Dras and Suru Valleys) nor in Kashmir proper.

They frequent bare rocky ground but are often to be seen feeding on moist ground near streams. The song is poor and very monotonous. The usual mode of progression is by running, not hopping. They have a peculiar way of flying, especially in the neighbourhood of their nests, a slow sort of hovering flight with the wings raised above the back and with tail spread, displaying the white of the wings and tail which is largely concealed when the bird is at rest. They are tame and fearless of man.

Breeding commences early, about the middle of May. Nests are placed under, or in narrow crevices in, rocks and are often very difficult to obtain without a crowbar, being often fully 2′ from the surface.

Nests are composed of fine yellow flowering stems of grass lined copiously with hair (of the yak, marmot, etc.) and with feathers.

The eggs are pure white. Four is the full complement. They vary in length from 24·6 to 20·7 and in breadth from 17·8 to 16·2.

The average of 21 eggs is 22·9 by 16·9.

112. Fringilauda nemoricola altaica. Stoliczka's Mountain-Finch.

This is a very common bird at high elevations in Kashmir, being found on both sides of the Himalayan Range and on the Pir Panjal but not in Ladakh proper. Its distribution does not overlap that of Adam's Mountain Finch. They are found in summer at elevations of from 11,000′, to 13,000′ above the limit of tree growth, and are generally more or less gregarious. They frequent open mountain sides, especially those which are strewn with rocks and boulders and they feed on the wet ground from which snow has just melted.

They have no song, only a sparrow-like call note.

Nesting commences in July, the nest of dry grass and weedstems, lined with hair, being placed well under a rock or large flat stone on the hill-side.

Eggs, 4 in number, are pure white, a beautiful pink when fresh and unblown ; they measure about 20·9 by 15·4.

113. Fringilauda brandti hæmatopyga. Tibetan Mountain-Finch.

This species is very common at high altitudes in Southern and Eastern Ladakh, rare in the upper portion of the Suru Valley, and not occurring in Kashmir proper. They frequent open rocky ground from 13,000′ to 17,000′. They are commoner and more gregarious than Adam's Mountain Finch, but they are sometimes seen with the latter. They are also very partial to wet ground where they may often be found feeding. They were kept under close observation from June 5 to July 23, but they did not appear to have nests. They probably breed a little later. This finch appears to have no song.

114. Emberiza fucata arcuata. The Indian Grey-headed Bunting.

This species is found on bush-covered hillsides in Kashmir, both main and side valleys, at from 6,000′ to 7,500′, but is nowhere common. They feed on the ground among bushes and dense scrub of *Berberis*, wild rose, *Cotoneaster*, *indigofera* and juniper. The cock has a bright short song, the best of all the buntings with which I am acquainted. It may be expressed in words as follows :—' Chick-chick-he'll get used to you-chick '.

Nesting commences about the middle of May. The nest is placed on the ground at the foot of some dense low bush on a steepish slope and is well concealed in grass. It is a very difficult nest to find. It is composed of dry grass and weed stems, lined with hair. Three or 4 eggs are laid which are pale green marked more or less all over with pale ashy-brown markings, and with none of the characteristic bunting lines.

They measure :—L., *20·5* × 14·7. B., 20·3 × *15·8*. S., *19·5* × 15·1. N., 19·7 × *14·9*. Average (10 eggs), 19·9 by 15·6.

115. Emberiza leucocephala. The Pine Bunting.

An occasional winter visitor to the Valley of Kashmir, as well as to the submontane tract. A small flock were seen at Pandrethan near Srinagar during the last week in November.

116. Emberiza stewarti. The White-capped Bunting.

Common in the submontane tract and around Rawlpindi in the winter, migrating up the Jhelum Valley into Kashmir in the end of March. They are very common on all the lower hills around the Valley of Kashmir from April to August. They frequent rocky hillsides, with or without bushes, between 5,500′ and 6,500′. They are specially partial to bare rocky slopes whereas *E. fucata* is only found where there is plenty of bush and scrub.

They are early breeders, nidification commencing about the middle of April. Fresh eggs are obtainable throughout May.

Nests of dry grass and weedstems, lined with hair, are placed in crevices in rocks or under stones on steep, often precipitous, rocky hillsides. Eggs, usually 4, more rarely 5, in number are dull white marked with dark reddish and purplish-brown, with sometimes a few streaks of the same colour.

They measure :—L., *21·6* × 14·6. B., 20·5 × *15·7*. S., *17·1* × 14·0. N., 18·6 × *13·4*. Average (98 eggs), 19·5 by 14·6.

The song of this bunting resembles the song of the yellow hammer, omitting the last long drawn note of the latter.

117. Emberiza cia stracheyi. The Eastern Meadow Bunting.

This is the commonest bunting in Kashmir, being found in summer on the Himalayan Range as well as on the Pir Panjal between 6,000′ and 12′000 and occasionally even higher. They are also found in Western Ladakh, in the upper portions of the Dras and Suru valleys, but not in the Indus Valley or beyond.

They frequent bush-covered hillsides, especially in the vicinity of cultivation.

Breeding commences early in June, and fresh eggs are obtainable throughout July and even in August.

The nest is placed on a steepish slope on the ground generally at the base of a low bush, indigofera, etc.

Three is the full complement of eggs laid. The eggs are often very handsomely marked with an intricate scrawl of fine dark purplish or brownish lines on a greyish-white ground.

They measure :—L. B., *23·8* × *17·1*. S. N., *20·2* × *15·0*. Average (102 eggs), 21·5 by 15·7.

The song of this bunting is short but pleasing.

118. Emberiza rutila. The Chestnut Bunting.

As single specimen of this bird was obtained on June 10 at the Tsokar Lake in Ladakh—elevation 15,000′. It would appear to be only a straggler.

119. Delichon urbica urbica. The House-Martin.

This is the common Martin of Ladakh including the Suru and Dras Valleys. From the middle of May they are fairly common along the Indus and Shyok rivers and their tributaries at from 10,000′ to 12,000′. Breeding commences early in June. Nests are composed of pellets of mud, lined with fine grass and feathers, with a small opening near the top and are placed on the face of cliffs under shelter of an overhanging rock. They are usually inaccessible but occasionally they can be reached. Nests are usually solitary or in small groups. Four eggs are laid, which measure about 19·0 × 13·6.

120. Delichon urbica cashmeriensis. The Kashmir Martin.

Common at high elevations on the Kashmir side of the Himalayan Range.

A big breeding colony was noticed near Astormarg at 12,000′ in the Lidar Valley. There were perhaps 100 nests in this colony, built up against the rock surface on an overhanging cliff some 40′ or 50′ from the ground and all quite inaccessible. Many nests contained fully fledged young in the middle of July.

121. Ptynoprogne rupestris. The Crag Martin.

A common bird throughout Ladakh—less common in Kashmir.

They arrive in the spring from the plains and are found throughout the summer months among rocky cliffs, especially in valleys and in the vicinity of water. They were observed at all elevations from 9,500′ to 15,500′.

Breeding commences in May in the Indus Valley, later at higher elevations. Nests resemble those of the English swallow being open half-saucers of mud built up against a rock surface under shelter of an overhanging ledge. The nest is lined with dry grass and feathers. Most nests are quite inaccessible but occasionally nests are found in places easy of access.

Four eggs are laid much resembling those of the swallow being white boldly marked with pale chocolate and with a few underlying purplish-grey markings.

Three eggs obtained averaged 21·1 by 14·2.

122. Hirundo rustica rustica. The Swallow.

This is an exceedingly common bird in the Valley of Kashmir where they are found in thousands throughout the summer. They begin to arrive from the plains of India in the first week of March and not infrequently they come in for a fall of snow after their arrival.

They begin nesting operations almost at once and by the third week in April most nests contain eggs.

Nests are built chiefly in native shops and verandahs. The main post office in Srinagar always contains many nests. They also build under the hulls of house-boats—just above the waterline. Four, 5 and 6 eggs are laid which resemble those of the English swallow.

They measure :—L., *22·3* × 14·0. B., 20·0 × *14·6*. S., *17·4* × 13·6. N., 22·0 × *13·1*. Average (78 eggs), 19·6 by 13·7.

Swallows leave Kashmir early in October.

(*To be continued*)

FURTHER NOTES ON

THE BIRDS OF THE AMBALA DISTRICT

BY

A. E. JONES, M.B.O.U.

In vols. xxv and xxvi of the Journal Mr. Hugh Whistler published some very interesting notes on the avifauna of the above district. His stay in those parts was of six months only, very inadequate indeed for working out anything like an exhaustive list for so large a tract of country.

Later, vol. xxix, p. 675, I gave a small additional list to that of Mr. Whistler's.

I deem myself very fortunate in having spent ten cold seasons in the district. The avifauna is rich and varied. Being on the eastern edge of the Punjab many species otherwise not occurring in our province just come into a narrow strip aligning the Western Jumna Canal. Some of these are winter visitors, a few resident, while several are strictly monsoon visitors.

In particular Jagadhri and Kalka were fairly well worked and fully repaid the time expended, exploring, as I did, all types of country.

In these notes I have amplified some of Mr. Whistler's observations where I have thought additional information advantageous, and recorded all species which do not appear in former lists.

Two flying visits were paid to Jagadhri, during the monsoon, one in July 1922, the other in July 1926.

The nomenclature and serial numbers are in most cases those of Mr. Stuart Baker's *Hand List*.

In conclusion I wish to thank Messrs. C. B. Ticehurst and Hugh Whistler for their encouragement and for identifying many of my specimens.

114. Garrulax leucolophus leucolophus, Hardwicke. The Himalayan White-crested Laughing Thrush.

While exploring the deep nullah just north-east of Kalka I heard at intervals avian sounds quite new to my ear. After scrambling about in the dense undergrowth for some considerable time I came on the originators of these strange sounds. There was a party of six or seven of this species feeding after the family habit among the dead leaves on the ground and I secured two without much trouble. It was a pleasing sight to see these beautiful birds against the dull drab leaf-strewn background. I afterwards found it very common higher up this same nullah between 2,500 ft. and 3,500 ft. It keeps to the heavy forest, is a great skulker but its cries betray its whereabouts. Also seen in Suket Territory on the right bank of the Sutlej River.

204. Pomatorhinus erythrogenys erythrogenys, Vigors. The Rusty-cheeked Scimitar-Babbler.

Not uncommon in the dense jungles between Kalka and Kasauli. More often heard than seen.

219. Pyctorhis sinensis sinensis, Gruelin. The Indian Yellow-eyed Babbler.

Quite common about the canal area at Jagadhri. Goes about in small parties of five to eight or nine during the cold season. In July they were in pairs and evidently breeding.

228a. Pellorneum ruficeps jonesi, Stuart Baker. The Western Spotted Babbler.

In the bamboo jungles just west of Kalka Station I first came across this species. It was usually seen near the small nullahs where there was abundance of undergrowth. First observed on December 26, 1919, when I secured one of a pair seen. Subsequently found to be not uncommon, though a great skulker.

328. Ixulus flavicollis flavicollis, Hodg. The Yellow-naped Ixulus.

Occasionally met with in the more open jungle in the vicinity of Kalka. Apparently it does not enter the plains.

344. Ægithina tiphia tiphia, Linn. The Common Iora.

One obtained at Chandigarh on February 20, 1921. In the same locality I saw this on one other occasion.

347. Ægithina nigrolutea, Marshall. Marshall's Iora.

About Jagadhri this species was seen on very few occasions. Two specimens taken, February 11, 1917 and February 22, 1920.

384. Molpastes hæmorrhous pallidus, Blyth. The Central Indian Red-vented Bulbul.

Mr. Whistler (*J.B.N.H.S.*, vol. xxv, p. 669) preserved no specimens of this species. I collected a small series and found two sub-species present in the district. The Ghaggar River roughly was the dividing line of this and the next sub-species, *pallidus* being on the Ambala side while *intermedius* occupies the territory on the Kasauli side. I could detect no intergradation between the two races.

385. Molpastes hæmorrhous intermedius, Jerdon. The Punjab Red-vented Bulbul.

Very common on the Kasauli side of the Ghaggar River and ascending the hills to an elevation of 5,000 ft. or more.

452. Chibia hottentotta hottentotta, Linn. The Indian Hair-crested Drongo.

One specimen was obtained two miles from Kalka, December 13, 1919. Subsequently seen in March when two or three individuals were seen to be paying attention to the Bombax (sp.) then in flower. A pair seen on a bare tree low down in the nullah below the cart-road at Koti on April 3, 1926. All at about 2,500 ft.

474. Tichodroma muraria (Linn). The Wall-Creeper.

Not uncommon among the earthen cliffs of the Ghaggar River about Chandigarh. One was obtained at Jagadhri on March 13, 1921, while it was climbing about the brick road-bridge over the canal.

501. Acrocephalus stentoreus brunnescens, Jerdon. The Indian Great Reed-Warbler.

A single specimen obtained at the Jagadhri Jheel on February 27, 1921.

505. Acrocephalus agricola agricola, Jerdon. The Paddy-field Warbler.

This species was noted about the Jagadhri Jheel on March 13, 1921, when I secured a single specimen.

536. Hippolais rama, Sykes. Sykes' Tree-Warbler.

Always on the look-out for this species I only succeeded in meeting it on one occasion, i.e., beside the race-course on March 13, 1920. Mr. Hugh Whistler kindly identified it for me.

546. Sylvia curruca minula, Hume. The Small Whitethroat.

One obtained at Ambala on January 15, 1921. It would appear to be a scarce visitor to the District as this was the only one obtained among a good series of Lesser Whitethroats.

573. Acanthopneuste occipitalis occipitalis, Blyth. The Large Crowned Willow-Warbler.

One was calling in the dâk bungalow compound, Ambala, September 1915.

582*a*. Seicerus burkii whistleri, Ticehurst.

Common Winter visitor to the foothills about Kalka 2,500 ft.

601. Hororins pallidus, Brooks. The Pale Bush-Warbler.

At Chandigarh one was obtained on November 13, 1921, from the self-same clump of Sarpatta grass from which one eluded me the previous year.

621. Prinia sylvatica sylvatica, Jerdon. The Jungle Wren-Warbler.

Capricious in its choice of habitat. I found this sprightly Wren-Warbler common in the foothills about Kalka and Chandigarh. Again at Darazpur and Jagadhri I found it right away from the hills. Males were in full song at the latter locality in July.

667. Pericrocotus erythropygius, Jerdon. The White-bellied Minivet.

I found this species somewhat scarce in the district. On two occasions I came across a small party frequenting the Keekur trees at the eastern corner of the race-course. Their behaviour on one of these visits was interesting; they would hover just above and then drop into the grass. One specimen obtained had the mandibles coated with a sticky substance like pollen. Adult ♂ ♂ were seen on no occasion which fact is rather interesting, as my friend the late S. Basil-Edwardes told me he found at Delhi a great predomination of this sex. From this it would appear that the sexes separate for the most part out of the breeding season. A juvenile ♂ obtained on March 5, 1921, had the testes quite normal whereas *peregrinus* at this date had commenced to breed.

678. Graucalus macei, Less. The Large Cuckoo Shrike.

Status rather obscure. My records are Kalka, March 7, 1920, and Ambala, three or four seen on January 14, 1923. These last appeared to be working towards the hills. The call-note is parrot-like and far-reaching. Two females examined, wing measurements 170, 178 m.m.

689. Oriolus oriolus kundoo, Sykes. The Indian Oriole.

Common summer visitor, widely spread over the district on both monsoon visits.

734. Sturnopastor contra contra, Linn. The Pied Mynah.

Very common about the canal area at Jagadhri where it is resident. In July several nests still contained young.

740. Siphia strophiata, Hodgson. The Orange-gorgeted Flycatcher.

Only one record, January 25, 1920 when one was obtained in the foothills at Kalka.

810. Saxicola insignis, Blyth. Hodgson's Bush-Chat.

Although always on the lookout for this species I saw it but once, December 17, 1922, when I noticed among a number of Bush-Chats frequenting the mowing-grass at the eastern corner of the race-course one bird considerably larger than the others. On collecting this bird I found it to be an adult ♀ of the above species.

894. Turdus boulboul, Lath. The Grey-winged Ouzel.

A winter visitor to the foothills, wandering at times a good distance into the plains. Noted at Chandigarh on one occasion where a small party was observed, an adult ♀ in the Cathedral compound at Ambala, and an adult ♂ at Jagadhri City, January 1, 1922.

908. Monticola erythrogaster, Vigors. The Chestnut-bellied Rock-Thrush.

During the cold season not uncommon in the foothills about Kalka. On one occasion an adult ♀ was seen in the Cathedral compound at Ambala when its jay-like alarm note attracted my attention.

919. Oreocincla dauma dauma, Lath. The Small-billed Mountain-Thrush.

Besides the one I obtained at Jagadhri on February 17, 1918 (*J.B.N.H.S.*, vol xxvi, p. 676) my friend A. H. Berriff obtained one at Rupar, November 1924.

957. Ploceus manyar flaviceps, Less. The Indian Striated Weaver-Bird.

Resident in the canal area at Jagadhri. Observed on many occasions (specimens obtained) during the cold weather. In July the birds were busily engaged with nesting operations. Bill of both sexes when in winter plumage, is pale yellowish horn.

961. Munia atricapilla, Vieill. The Chestnut-bellied Munia.

Possibly a regular monsoon visitor to the canal area at Jagadhri. On my first visit in July 1922 I saw two pairs engaged in nesting operations. On the second monsoon visit July 1926 two or three pairs were seen besides a party of four.

1024. Metoponia pusilla, Pall. The Gold-fronted Finch.

A pair seen flying over the nullah beside the Grass-Farm at Kalka on March 5, 1922. Elevation 2,500 ft.

Passer domesticus parkini, Whistler. The Kashmir House Sparrow.

One adult ♂ obtained from a large flock at Jagadhri on March 12, 1925. When I found them roosting in the reeds beside the canal. Mr. Whistler to whom I submitted the specimen tells me the wing measurement (84 mm.) exceeded any he had previously examined.

1059. Emberiza cia par, Hartert. The Transcaspian Meadow-Bunting.

Mr. Whistler records *stracheyi* at Kasauli, so that this race would appear to be strictly confined to the hills. The Transcaspian Meadow Bunting however is the bird commonly found in the district during the winter. I obtained it at Chandigarh and found it extended to the eastern limits of the District where conditions suited its requirments.

1063. Emberiza aureola, Pall. The Yellow-breasted Bunting.

At Jagadhri among a flock of *E. leucocephala* frequenting a threshing floor I saw an adult male Yellow-breasted Bunting which I obtained on February 22, 1920.

1069. Emberiza striolata striolata, Licht. The Striolated Bunting.

In the broken country about Chandigarh I frequently came across this curious little Bunting during the cold weather. None of the specimens obtained exhibited any trace of breeding activity.

1072. Melophus melanicterus, Gruel. The Crested Bunting.

Only once noted i.e., on the Handresra road six miles from Ambala, March 17, 1918, when an adult ♀ was obtained from a party of three or four.

1078. Riparia riparia diluta, Sharpe and Wyatt. The Pale Sand-Martin.

A single specimen was obtained on March 12, 1922, from a congregation of Sand-Martins and Swallows (*H. rustica*) on telegraph-wires at Jagadhri. It is interesting to note that the genital organs of this adult ♂ were quite normal, while from this same assemblage a fully-fledged juv. *brevicaudata* was obtained with the next shot. Another fact in relation to *diluta* is that a specimen obtained on June 6, 1921, close to Simla exhibited breeding activity, the testes being the size of a No. 4 shot. The wing of the Jagadhri specimen is 103 m.m.

1091. Hirundo daurica nepalensis, Hodgson. Hodgson's Striated Swallow.

Probably a regular winter visitor, breeding in the adjacent hills from about 6,000 ft. to possibly 9,000 ft. Three specimens which Mr. Hugh Whistler kindly identified for me were obtained on November 27, 1921, from a flock of 200 or 300 near Jagadhri. Wings 115, 115, 114 mm. All are in deep moult.

1092. Hirundo daurica erythropyga, Sykes. Sykes' Striated Swallow.

Three specimens of this race, in beautiful fresh plumage, were obtained on various dates and at different spots during December. Wing measurements, 110, 111, 115 mm.

1099. Motacilla alba hodgsoni, Gray. Hodgson's Pied Wagtail.

During the cold weather I used to find this sub-species not uncommon along the Gaggar River at Chandigarh and Mubarikpur. Once at Jagadhri.

1102. Motacilla flava thunbergi, Billberg. The Grey-headed Wagtail.

Dr. C. B. Ticehurst was kind enough to identify my small series of Yellow Wagtails. Their status is somewhat obscure owing to the fact that full plumaged birds are comparatively scarce during the cold season. In fact most birds were in deep moult even in March when I used to leave for the Hills. My series include this and the following races :—

1103. Motacilla flava melanogriseus, Homeyer. The Blue-headed Wagtail.

1104. Motacilla flava beema, Sykes. The Indian Blue-headed Wagtail.

1108. Motacilla citreola citreola, Pall. The Yellow-headed Wagtail.

1109. Motacilla citreola citreoloides, Gould. Hodgson's Yellow-headed Wagtail.

Both these Yellow-headed Wagtails were fairly common about the district during the cold weather, but whereas I was able during March to obtain the former in full breeding-dress, *citreoloides* was at this time only about half-way through the moult.

1125. Anthus roseatus, Hodgson. The Rosy Pipit or Hodgson's Pipit.

A bird of the marshes and jheels in winter. Very common about Jagadhri at this season.

1137. Melanocorypha bimaculata, Menetries. The Eastern Calandra Lark.

A common winter visitor. Flocks varied from fifty to several hundred individuals. Very noticeable is the constant warbling which goes on while the birds are running about the ground. Specimens obtained in March were very fat.

1138. Alauda arvensis cinerascens, Ehucke. The Eastern Sky-Lark.

In the neighbourhood of Cantonments I used to see a few birds about the race course and Grass-farm. Small flocks were the usual order of things. Larger flocks seen passing over at considerable heights.

1142. Alauda gulgula gulgula, Franklin. The Small Indian Sky-Lark.

Common on the grazing-grounds near the canal at Jagadhri and paired off in March. None were seen on either of my July visits.

1143. Alauda gulgula guttata, Brooks. The Small Kashmir Sky-Lark.

Only one specimen of this race was obtained. This was at Darazpur on December 11, 1921, when a number were seen in the wheat fields. Probably a regular winter visitor.

1149. Calandrella brachydactyla longipennis, Evers. The Yarkand Short-toed Lark.

Some attention was paid to the Short-toed Larks. Mr. Hugh Whistler was good enough to look through my small series and identify them for me. I found this a very common bird in the more highly cultivated tracts, feeding generally about the stubble or recently ploughed fields, the flocks sometimes comprising several hundred birds.

1152. Calandrella acutirostris tibetana, Brooks. Brooks's Short-toed Lark.

A single specimen obtained which Mr. Whistler kindly identified for me. This was at Darazpur on December 11, 1921. It was squatting on a small foot-path through tall grass. My shot disturbed other similar birds from the immediate vicinity which were in all probability of the same subspecies.

1159. Mirafra assamica, McClell. The Bengal Bush-Lark.

Resident in the canal area at Jagadhri. I found it in no other part of the District.

1184. Æthopyga siparaja seheriæ, Tickell. The Himalayan Yellow-backed Sun-bird.

Found not uncommonly in the low jungle at Kalka where it is resident, from 2,500 ft. to 3,500 ft. ♀♀ in first plumage have red throats, probably ♂♂ are the same.

1244. Pitta brachyura, Linn. The Indian Pitta.

A common summer visitor to the foothills where its melodious disyllabic note attracts immediate attention. Ascends the hills to about 3,500 ft. I attribute several old stick nests found in the cold season to this species.

1260. Picus striolatus, Blyth. The Little Scaly-bellied Green Woodpecker.

Only a single specimen obtained strictly within the Ambala District boundary, on February 26, 1922, at Jagadhri. In the adjoining Karnal District, at Ladwa I found it by no means rare. Probably a winter visitor wandering into the plains at this season.

1283. Dryobates macei macei, Vieill. The Fulvous-breasted Pied Woodpecker.

Sparsely distributed in the lower hills from 2,500 ft. upwards.

1290. Iyngipicus pygmæus, Vigors. The Himalayan Pigmy Woodpecker.

Not uncommon in the better forested parts of the foothills up to 4,000 ft. Young out of nest seen at Koti (3,500 ft.) on June 3, 1922.

1292. Iyngipicus hardwickii, Jerdon. The Indian Pigmy Woodpecker.

Thinly distributed over the district and probably much overlooked. Two eggs were taken from a hole in a ' Kikur ' tree on March 27, 1915.

1335. Megalæma virens marshallorum, Swinhoe. The Great Himalayan Barbet.

Descends to the foothills just above Kalka (2,500 ft.), during cold weather.

1365. Merops superciliosus javanicus, Horsf. The Blue-tailed Bee-eater.

Abundant on both monsoon visits to Jagadhri where I found it breeding in the banks of the canal. Two specimens taken. Leaves the district before November.

1374. Alcedo atthis pallasii, Reichn. The Central Asian Kingfisher.

The small series of these kingfishers collected by me during the cold seasons were identified by Mr. Hugh Whistler as pertaining to this race.

1418. Upupa epops epops, Linn. The European Hoopoe.

This is the race that occurs so commonly throughout the district during the cold weather.

1420. Upupa epops orientalis, Stuart Baker. The Indian Hoopoe.

Ambala is the type locality of this race. It is probably the breeding bird of this district; I took one on March 10, 1921, which I attribute to this sub-species.

1423. Micropus melba melba, Linn. The Alpine Swift.

While waiting for a train at Ghaggar Station on the evening of July 31, 1926, I was surprised to see two large swifts. Bats were out in some numbers and the light anything but good and their identity was obscure till I shot one, which proves to be an adult ♂ of this species. Testes small. Primaries much abraided. Traces of moult on body and wing-coverts. The gizzard contained a mass of Coleoptera.

1454. Caprimulgus monticolus, Franklin. Franklin's Nightjar.

A summer visitor to the submontane tracts. One heard at Chandigarh on March 19, 1922. Common about the barer hills near Kalka up to 4,000 ft. Eggs (fresh) taken on June 3, 1922 at 3,500 ft.

1457. Caprimulgus macrurus nipalensis (Hartert). The Nepal Long-tailed Nightjar.

Common summer visitor to the lower hills up to 5,500 ft. Arrives about first week in March when its characteristic note may be heard at dusk. A specimen taken at Kalka on July 16, 1922, was in deep moult. Its favourite haunts are the deep-wooded nullahs.

1461. Caprimulgus indicus jotaka (Temm.) The Himalayan Jungle Nightjar.

Probably winters in the foothills. One was seen at very close quarters at Kalka, 2,500 ft. on December 26, 1919.

1472. Cuculus canorus telephonus (Hein). The Asiatic Cuckoo.

It was somewhat surprising to find this species quite common at Jagadhri on both monsoon visits. Both sexes were heard.

1493. Clamator jacobinus (Bodd.) The Pied Crested Cuckoo.

During July this species is widely and commonly distributed over the district.

1524. Psittacula schisticeps schisticeps (Hodg.) The Slaty-headed Paroquet.

Occasionally descends to the foot of the hills. A small flock observed close to the grass-farm at Kalka on March 5, 1922, when two specimens were taken.

1535. Tyto alba javanica (Gmel.). The Indian Barn Owl.

Two or three pairs annually breed about the barracks ; another pair in the Sudder Bazaar near the R. C. School. Young were out of the nests early in November.

1541. Asio flammeus flammeus, Pontoppidan. The Short-eared Owl.

A fairly common winter visitor ; frequently put up when partridge-shooting. One taken on the Dairy Farm on March 16, 1922.

1547. Strix ocellata ocellata, Less. The Mottled Wood-Owl.

A pair had their quarters in some enormous banyan trees at the western corner of the Artillery Maidan.

1556. Bubo bubo bengalensis, Frankl. The Indian Great Horned-Owl.

Fairly common about Jagadhri where I found four hard-set eggs on March 12, 1922, from which one of the parent birds flew. The ' nest ' was a small saucer-shaped depression in the earthen bank of the canal, the eggs simply resting on the bare earth. The situation was exposed to the full glare of the sun at midday!

1557. Bubo coromandus (Lath.) The Dusky Horned-Owl.

As Mr. Whistler supposes it is common and resident. I found many eggs of this species. Two would appear to be the full clutch. Nests were usually high up and are probably the ancient domains of Honey-Buzzards, Tawny Eagles or *Neophrons*. One nest besides the two chicks contained a leveret, another contained a decapitated *Lobivanellus indicus !* The laying season is the latter half of December and first half of January.

1586. Glaucidium brodiei, Burton. The Collared Pigmy Owlet.

One seen and wounded close to the grass-farm at Kalka. Elevation 3,000 ft.

1611. Hierauetus pennatus, Gmel. The Booted Eagle.

Not uncommon in the cold season, when a few take up their abode in the neighbourhood of Cantonments. One dark bird used to frequent the vicinity of the Station Hospital, its presence being proclaimed by its sharp clanging cries. Two specimens obtained (♂ and ♀), were both of the pale phase. Their gizzards contained remains of the Palm Squirrel.

1653. Buteo buteo rufiventer (Jerd.) The Common Buzzard.

I attribute a female (wing 368 m.m.) to this sub-species Mr. Whistler mentions *Buteo ferox* in his list (*J.B.N.H.S.*, vol. xxvi, p. 181) and a male with a wing of 406 m.m. must, I think, belong to this latter species. Both those obtained are in the pale phase of plumage.

1677. Falco peregrinus peregrinator (Sund.) The Indian Peregrine Falcon.

A pair of this species took up their abode at the Cathedral in January and February 1923. The pair of Luggars (*F. jugger*), which hitherto had bred annually on the steeple, in face of the invasion, quite deserted the locality.

1695. Crocopus phœnicopterus phœnicopterus (Lath.). The Bengal Green Pigeon.

Both this and *chlorogaster* were obtained close to Cantonments. I found the former race very common at one locality (3,500 ft.) in the low hills below Kasauli. This was in April 1922 when some of them were seen pairing.

1727. Palumbus palumbus casiotus (Bonap.) The Eastern Wood-Pigeon.

Observed at Kalka on two or three occasions. They appeared to be straggling back to the hills to roost.

1783. Gennæus hamiltoni (Griff.) The White-crested Kalij Pheasant.

I can vouch for this pheasant being found in the district from 2,500 ft. upwards.

1860. Turnix javanica taijoor (Sykes.) The Common Bustard-Quail.

Obtained at Darazpur on December 11, 1921, and again at Kalka on March 5, 1922.

1863. Turnix tanki tanki, Blyth. The Indian Button-Quail.

On the last-mentioned date (March 5, 1922) also at Kalka, a pair of this Button-Quail was obtained. They were frequenting rather heavy bamboo jungle.

1872. Porzana pusilla (Pallas.) The Eastern Baillon's Crake.

One specimen obtained on March 12, 1922, at Jagadhri.

1874. Porzana porzana, Linn. The Spotted Crake.

Hearing a Rail-like note issuing from a patch of swamp I had it beaten out and was rewarded by getting a specimen of the above. Jagadhri, February 22, 1920.

1879. Amaurornis fuscus bakeri, Hartert. The Northern Ruddy Crake.

Two specimens taken on February 27, 1921 and January 1, 1922, both at Jagadhri where I found them frequenting the reed-grown banks of the canal-spill.

1882. Amaurornis akool (Sykes.) The Brown Crake.

At Chandigarh one was shot on a small irrigation canal on November 13, 1921. Another was obtained December 4, 1921, at Jagadhri when my dog routed one out of a small damp nullah. Several seen at Jagadhri July 30, 1926.

1884. Amaurornis phœnicura (Pennant.) The White-breasted Water-hen.

A specimen was brought to me in the flesh. It had been shot by a friend between Chandigarh and the Ghaggar River on February 4, 1922. Another was flushed by me from the margin of a small wet nullah on July 16, 1922, at Jagadhri.

1887. Gallicrex cinerea, Gmel. The Kora or Water-Cock.

In the early morning of July 31, 1926, one, a male, flew across the canal. With my glasses I had an excellent view of it the frontal horn making identification unmistakable.

1901. Chlamydotis undulata macqueeni, Gray. Macqueen's Bustard or Houbara.

In December 1919 Lt. C. S. Murray of the Physical Training School shot three or four between Barara and Kesri. During the same winter Col. A. K. Appelby's falcons caught others at Rajpura.

1916. Hydrophasianus chirurgus (Scop.) The Pheasant-tailed Jacana.

A pair or two seen at Jagadhri on July 16, 1922. One bird was seen to pursue a kite (*M. govinda*) as if the latter had ventured too near its nest. Several were seen July 30 and 31, 1926, when one was seen standing over its nest.

1920. Sarciophorus malabaricus, Bodd. The Yellow-Wattled Lapwing.

Definitely identified at Darazpur, February 15, 1922. It is very rare in the district. A few pairs annually seen on some fallow land near Ladwa, Karnal District, where they breed.

1964. Philomachus pugnax, Linn. The Ruff and Reeve.

At Jagadhri on February 26, 1922, I obtained a ♂ from a flock of about fifteen birds. Again at the same place March 12, 1922, three females were shot from a large flock. The tarsi of these latter varied from olive-green to dusky shrimp-pink.

1989. Rostratula benghalensis benghalensis, Linn. The Painted Snipe.

Only observed about Darazpur and Jagadhri. At the latter place on March 26, 1922, I think the birds had only just arrived for it was the only occasion on which I met with it here. Four specimens preserved showed the genital organs were becoming active. Apparently a summer visitor.

2062. Pseudotantalus leucocephalus leucocephalus, Penn. The Painted Stork.

In March 1921 I noted three birds perched on the topmost branches of some Pipal (*F. religiosa*) trees in the village of Mustafabad. Probably common about Jagadhri during the monsoon as several were noted July 30, 1926.

2063. Anastomus oscitans, Bodd. The Open-bill.

Common monsoon visitor. Many seen at Jagadhri on both my July visits to that place.

2079. Butorides striatus javanicus, Horsf. The Indian Little Green Heron.

One specimen obtained at Chandigarh on November 13, 1921. It was flushed from a small irrigation canal. Others were seen at Jagadhri, July 30, 1926.

2081. Nycticorax nycticorax nycticorax, Linn. The Night Heron.

I used to hear (and occasionally see) a few of these birds winging their way to their feeding grounds. Their line of flight usually took them across the north-east corner of cantonments, their direction was almost due east.

2083. Ixobrychus minutus minutus, Linn. The Little Bittern.

Very common about the jheel and canal at Jagadhri. By no means shy of observation.

2085. Ixobrychus cinnamomeus, Gmel. The Chestnut Bittern.

On July 31, 1926. Three were observed at daybreak flying about over the tall bullrushes at the northern end of the jheel at Jagadhri.

2097. Nettopus coromandelianus, Gmel. The Cotton Teal.

Apparently a summer visitor to Jagadhri. A few pairs were seen on both my monsoon visits to that place.

2107. Dendrocygna javanica, Horsf. The Lesser or Common Whistling Teal.

Three or four pairs were seen at Jagadhri on July 16, 1922 and one pair on July 30, 1926, by which, I think, it is a regular monsoon visitor to the locality. Years ago I remember shooting some during the cold season near Kasur, Punjab.

Colymbus arcticus, The Black-throated Diver.

This I have already reported (*J.B.N.H.S.*, vol. xxviii, p. 1134).

A CRITICAL REVIEW OF SIR J. C. BOSE'S 'NERVOUS MECHANISM OF PLANTS'

BY

R. H. DASTUR

(*Communicated by E. Blatter, S. J., Ph. D., F.L.S.*)

In his recent publication Sir J. C. Bose has tried to show that the nervous mechanism of plants is similar to that of animals. His conclusions are based on the experimental evidence he has gathered on working with sensitive plants, especially *Mimosa pudica*. He first tries to show that the conduction of excitation is purely a physiological phenomenon and not a physical one as was supposed by Pfeffer, Haberlandt and others. He has attempted to show that the hydro-mechanical theory of Haberlandt is inadequate as the transmission of excitation to a distance can be affected by a scratch, by superficial friction and by an electric shock of feeble intensity, and a deep wound or an escape of a drop of water are not necessary as, according to Bose, was put forward by Haberlandt. Similarly he has tried to disprove the theory of transpiration current conduction.

In order to obtain evidence to support his view that the nervous mechanism of plants is similar to that of the animals he has studied the polar action of an electric current in *Mimosa* and other plants just as it has been done on animal nerves and finds that the same kinds of reactions are obtained with plants also. He shows that, as in the case of animal nerves, the excitation under a feeble current, is produced at kathode make, and under a stronger current it is produced both at kathode make and anode break. From these experiments he concludes that the conduction takes place through the physiological propagation of protoplasmic excitation.

He has determined the velocity of transmission of excitation by his resonant recorder and has found that in summer in the thick petioles of *Mimosa* it varies from 30 to 55 mm. per second and in thin petioles it is as high as 400 mm. per second. But in winter it is very much lower on account of the physiological condition of the plant.

In case of animals, the nervous impulse is arrested when an electrotonic block is interposed in the path of conduction. Bose has shown that the same holds good for plants thus showing the similar nature of nervous mechanism in both. He has also shown that application of ice brings about a temporary loss of conduction power and poisonous solutions completely destroy it.

He assigns the task of conducting the impulse in the case of *Mimosa* to certain tubular cells in the phloem region. He thinks that the sieve tubes do not conduct the impulse. According to him protoplasmic continuity is not necessary through the perforations of the transverse cell walls of the sieve tubes as the unperforated transverse wall of the tubular cells do not hinder the transmission and act like the synapsoidal membranes of the nerves of animals. The transverse walls behave as synapsoidal membranes is supported by the fact that on account of their presence the conduction of the impulse is irreciprocal. He shows that the excitation passes from the tubular cells to the motor cells of the pulvinus and brings about its contraction but the contraction of the pulvinus does not excite the tubular cells.

It is further maintained by him that besides the sensitive plants other non-sensitive plants are also excitable. In the case of the sensitive plants the excitatory process is externally made visible by the contraction of the motor organs but in non-sensitive plants there are no such motor organs which can show the excitations. In such plants the transmission of excitation is detected by him by an electric change of galvanometric negativity. By this method he has obtained electric positive and negative responses from the stems, roots and petioles, of non-sensitive plants. He therefore concludes that nervous conduction is not only confined to the sensitive plants but is also present in the non-sensitive plants.

By the help of the above method he has localized the nervous tissue of *Mimosa* by means of an electric probe. He pushes the electric probe in the petiole of *Mimosa* and when it reaches the external and internal phloem regions, the strongest galvanometric negativity is obtained though some positive and negative responses are obtained when the probe reaches the epidermal and cortical tissues.

After showing that the phloem region constitutes the nervous tissue of plants he isolates the steles which contain the phloem from the petiole of fern and repeats the characteristic reactions with them carried out with the nerve of the frog in animal physiology. He finds that the characteristic responses of the plant and animal nerves are in every way similar, in both the normal and modified conditions. He therefore concludes that the physiological mechanism of the excitatory condition is the same in both.

The four sub-petioles bearing the leaflets have a definite nerve connection with the pulvinus of the main petiole of the compound leaf. The vascular ring of the pulvinus is divided into four quadrants, each quadrant, has a nerve connection with each of the sub-petioles. When a sub-petiole is feebly stimulated, excitation is transmitted to the corresponding quadrant of the pulvinus which responds to the stimulus. When the intensity of the stimulus is increased the ingoing or the afferent impulse on reaching the corresponding quadrant of the pulvinus does not remain localized as it does in the case of the feeble stimulus but is reflected along a new path as an efferent impulse and thus a reflex are is formed at the centre. The efferent impulse travels in the reverse direction and causes the fall of another sub-petiole. In order to cause the fall of another sub-petiole the afferent impulse, as he suggests, passes from the outer phloem to the inner phloem after crossing the xylem and from the inner phloem to the inner phloem of the opposite quadrant in nerve connection with the other sub-petiole after crossing the pith.

He then measures the velocity of conduction of the impulse in the outer and inner phloem regions of the vascular bundles and finds that the velocity of the impulse is seven times greater in the inner phloem than in the outer phloem.

He also measures the velocity of the afferent impulse and also of the efferent impulse and finds that the velocity of the efferent impulse is seven times greater than the velocity of the afferent impulse. He therefore concludes that the efferent impulse is the motor impulse and travels through the inner phloem and the afferent impulse is the sensory impulse and it travels through the outer phloem. Consequently he comes to the conclusion that the outer phloem constitutes the sensory nerve and the inner phloem the motor nerve.

In trying to disprove the hydromechanical theory of Haberlandt, Bose has made some incorrect statements. He states that according to the hydromechanical theory, a deep wound or an escape of a drop of water from the stem or petiole is essential for the transmission of the impulse. Bose by his experiments Nos. 2 and 4 shows that transmission takes place in complete absence of any wound or without the escape of water under the stimulus of superficial friction or by an electric shock. According to Haberlandt an escape of water outside is not essential for the conduction of the impulse. He in order to show that the stimulus conducting cells described by him are highly turgescent tubes, makes an incision in the petiole to lay them open and the escape of water from these cells when they are cut across, indicates that they are really turgid, and he shows by microchemical tests that the escape of water takes place through these turgid cells and is not derived from the woody cylinder as the sap that exudes out is not pure water. So the escape of water was shown to demonstrate the turgid nature of the stimulus conducting cells and had no relation to the transmission of the impulse. The hydromechanical theory of Haberlandt is different from what is represented by Bose in his book. According to the hydromechanical theory there are certain turgid tubular cells in the phlœm region and they form a continuous system. When a shock stimulus produces a contraction of the pulvinus, a pressure is exerted on the highly turgescent stimulus transmitting cells. The rise of pressure is transmitted in these cells as a pressure wave. The wave of compression or positive tension acts like a shock stimulus upon the motor tissue of the next near pulvinus and causes the curvature of the latter. In the case of the traumatic stimulus (wound stimulus) there is a fall of the pressure in the stimulus transmitting cells owing to the escape of water due to wounding and the fall in pressure is transmitted as a wave of relaxation which produces a disturbance in the adjacent pulvinus and causes its curvature.

As it is clear from the above that the experiments of Bose in no way affect the hydromechanical theory and his contention that transmission of impulse in *Mimosa* is not hydromechanical remains unsupported. It may be true that the previous workers may have failed to see that the impulse is conducted to a long distance even when the stimulus applied is very feeble and their failure to notice this feature may be due to the fact that the sensivity of *Mimosa* varies according to the season or the age of the plants.

His experiments on the polar action of electric current to demonstrate the similarity of reactions between plant and animal nerves are not above criticism. In the experiments on the animal tissues the two electrodes are placed at two different points on the muscles. At the make of a feeble current the excitation is produced at the kathode and at the break it is not produced at either electrode. In the case of a strong current the excitation is produced at the kathode at the make of the current and at the anode at the break of the current. In his experiments on the plant tissues Bose makes use of a monopolar method in which the pulvinus is made both the anode and the kathode alternately, by means of a special device, the second electrode being applied to some indifferent point on the stem. Bose does not state any reasons for having used this monopolar method. In order to show the similarity of reactions if two separate points had been made the anode and the kathode the experiments would have carried more conviction.

From the above experiments he argues that the excitation is produced on account of physiological causes and not to any physical disturbance, but it is very likely that a certain amount of physical disturbance is produced in the form of vibrations when an electric current is passed.

Pfeffer in order to show that the transmission of stimuli can take place without the help of the living protoplasm anæsthetized the petiole by means of chloroform or ether and he found that the traumatic or shock stimuli traversed the narcotized regions. Bose evidently suspects the correctness of the statement of Pfeffer when he says, 'It is extremely doubtful whether the conducting tissue in the interior can be effectually narcotized by the external application of an anæsthetic.' Similarly he suspects the scalding experiments of Haberlandt when he says, 'The conducting tissue was supposed to have been killed by scalding' and 'If this really had been the case.'

Preffer has clearly stated that he had anæsthetized the *middle portions* of petioles by means of chloroform or ether and so there is no reason to suspect the narcotization of the conducting tissue. Haberlandt has also equally clearly stated that the petiole was killed outright by scalding.

Bose has shown that when unilateral stimulus is applied to a stem the propagation of the impulse takes place, up or down, in the same vertical line and the course of the impulse is restricted to the stimulated side only, the other side of the stem showing no excitation. In the case of a strong stimulus the impulse is transmitted on the other side of the stem after crossing over the apex. From this he concludes that there are two main conducting strands which meet at or near the apex.

The unilateral conduction of the stimulus appears to be due to the course of the vascular bundles entering the stem from the leaves. The leaf trace bundles travel inside the stem through two internodes and fuse with the leaf trace bundles entering from the second node below. It is well known that the conduction of water and food substances occurs more rapidly in a longitudinal direction than in a radial direction as in the latter case many walls have to be passed through. If the impulse is conducted through the phloem region it would certainly be conducted more rapidly in the longitudinal direction than in a radial direction and on account of the course of leaf trace bundles, as the phloem regions of the second and fourth leaves are connected with one another, the impulse will be received by the second and the fourth leaves and not by the third leaf on the stem. For radial conduction of the stimulus a stronger stimulus will be necessary. So the experiments of Bose prove nothing new. His contention that the stimulus conducting strands meet at the apex where the impulse crosses from one side to the other is not well supported. He considers some tubular cells in the phloem region to be the conducting tissue and he distinguishes them by staining. They are stained purplish blue by hæmetoxylin while safranin has no effect on them. The tubular cells form two independent strands on the two opposite sides of the stem and they meet near the apex as Bose finds that the tissue at the apex is also stained purplish blue. It may be pointed out that at the apex the different tissues are not differentiated and the cell walls of all the cells at the apex are made of cellulose and consequently they all take up the hæme toxylin stain. Since the morphogenetic differentiation of the cells does not occur near the apex the conclusion of Bose that the strands of the tubular cells meet at the apex cannot be correct. If the impulse on one side of the stem produced on account of unilateral stimulation crosses over the apex to reach the other side of the stem it clearly means that the impulse is conducted through the cells which are entirely undifferentiated and it is not conducted through the tubular cells which according to Bose form the nervous tissue. When Bose puts forward that the tubular cells in the phloem region are the conducting elements, no mention is made by him of the stimulus transmitting cells so fully described by Haberlandt in the phloem region of *Mimosa* and other plants. Bose has neither described the histological nature of the tubular cells nor does he say how to distinguish them. He also does not say how his tubular cells differ from the tubular stimulus transmitting cells of Haberlandt. In absence of any description the tubular cells of Bose from the photographs appear to be ordinary phloem parenchymatous cells.

Bose does not seem to be definite about the tissue which actually conducts the impulses. At one place he assigns the task of conduction to the tubular cells and at other places he speaks of the phloem as the conducting tissue. Evidently he has no evidence to show that the tubular cells form the nervous tissue.

It follows from the above that his statement that the sieve tubes do not conduct the stimulus is quite unwarranted. Even granting that the presence of perforations in the septa is not necessary for the conduction of the impulse it does not follow that their presence in any way hinders the propagation of the impulse.

His comparison of the transverse septa of the tubular cells with the synapsoidal membranes appears to be very far-fetched. He wants to show that on account of the presence of the septa the conduction of the impulse is irreciprocal at the junction of the plant nerve with the motor tissue of the pulvinus, as it is in the case of neuro-muscular junction. In the case of animals the excitatory impulse cannot pass from the muscle to the nerve on account of the valve action of the synaptic membrane between the nerve ending and the muscle fibre. Bose wants to show that the excitation of the motor cells of the pulvinus does not pass to the nerves. When he stimulates the pulvinus of a petiole held in the jaws of a clamp by scratching with a pin he finds that the contraction of the pulvinus takes place but the impulse is not transmitted to the sub-petioles showing that the excitation is not conducted. From this experiment he concludes that the excitation of the motor tissue is not passed to the nerves. In his experiments Nos. 2 and 4 Bose has shown that by superficial scratching of the stem the stimulus is transmitted to a long distance. He does not say then how the stimulus is transmitted to the nervous tissue embedded in the inside of the stem. If the stimulus can pass through the epidermal and cortical parenchymatous cells there is no reason why it should not pass through the parenchymatous cells of the pulvinus.

He proves that the phloem region is the nervous tissue of plants by showing that the greatest negative response is given by the plant when the electric probe reaches the phloem tissue. On account ot the maximum induced electric change produced when the phloem tissue is reached by the probe he concludes that it is the conducting tissue of plants. But as it is clear from his own experiments that the conduction of the impulses takes place through other tissues also. (1) The conduction of the stimulus takes place through undifferentiated cells at the apex, if according to Bose the impulse crosses over the apex. (2) In his experiments with the electric probe he has found that the positive and negative electric responses are given by the epidermal and cortical cells and it shows that these tissues can conduct the stimulus to a certain extent. (3) As will be shown later on, Bose calls the outer phloem as the sensory nerve and the inner phloem as the motor nerve and when a sensory impulse is changed into a motor impulse it must pass from the outer phloem to the inner phloem and consequently it passes through the intervening xylem tissue. Similarly he shows that the impulse in order to reach another nerve it in addition passes through the pith.

Finally Bose has tried to show that the differentiation of sensory and motor nerves has occurred in the nervous tissue of *Mimosa*. He has put forward the view that the outer phloem of the bicollateral bundle in *Mimosa* is the sensory nerve and the inner phloem as the motor nerve, and the formation of the reflex arc takes place at the pulvinus of each petiole.

It was pointed out above in his experiment to show irreciprocal conduction that by superficial scratching of the pulvinus of a petiole held in a clamp the contraction of the motor tissue takes place but the excitation is not transmitted to the nerve ends. Now in order to show that each quadrant of the pulvinus has a nerve connection with the corresponding sub-petiole he rightly excites the nerve ends (not by scratching) by thrusting a pin. He clearly says on page 173, 'These can be separately stimulated by thrusting a sharp pointed pin into each of the four quadrants till the nerve end is reached.' And he shows that the corresponding sub-petiole is affected. But in his experiments to show that the outer phloem forms the sensory nerve he excites the outer phloem by superficial scratching (page 189) which is in direct contradiction to the method adopted to show irreciprocal conduction and the method used in his experiment No. 85 (page 173–174). The experiments are performed under identical conditions and the contractile tissues are found in both the pulvinus of the main petiole and in those of the sub-petioles. So at one place he maintains that the outer phloem is not affected by superficial scratching (pages 45 and 173–174) and a thrust of the pin to excite it is necessary while at other place (page 189) he employs a scratch stimulus to excite the outer phloem when also the impulsive fall of the leaf is avoided as in the experiment 19.

Bose has got very slender evidence to show that the outer and inner phloems constitute the sensory and motor nerves of *Mimosa*. Among animals the sensory nerve carries the stimulus to the reflex centre and the impulse is reflected back as the motor impulse along the motor fibres, which bring about the contraction of the muscle. But in *Mimosa* when a sub-petiole is stimulated the stimulus is transmitted to the pulvinus of the main petiole and before it is reflected back as the motor impulse it gives rise to an impulse which is responsible for the responsive movement of the main pulvinus due to the contraction of the motor tissue. Therefore the outer phloem does not merely carry the sensation to the reflex centre but it also causes the contraction of the main pulvinus and so it discharges the function of a motor nerve. Again in figure 79*a* he shows that the outer phloem carries an out-going impulse while a sensory nerve always carries an ingoing impulse. For the reasons shown above there is no justification in calling the outer phloem a sensory nerve.

In his experiment No. 94 he stimulates the outer phloem by scratching the pulvinus and the inner phloem by thrusting a pin. It is difficult to understand how one can be sure of stimulating the outer phloem alone by external scratching and the inner phloem alone by thrusting a pin when the pin has to pass through the outer phloem first in order to reach the inner phloem. So it would not be right to assume that the outer phloem carries the slower impulse or the inner phloem the more rapid one. It is evident that the longer time taken for conduction of the impulse when the pulvinus is excited by a scratch stimulus and the shorter time when a wound stimulus is applied are due to the difference in the intensities of the stimuli applied.

It is clear from the above that the experiments of Bose do not prove that the differentiation of the sensory and motor nerves has taken place in *Mimosa*.

There are many such misstatements, errors and discrepancies in this book by Bose and they can be dealt with if one has more time and greater stock of patience.

It was long suspected that the vascular system on account of its ramifications into every part of a plant was the channel for the transmission of stimuli. The xylem part of the bundle was first thought to be the conducting part and it was later shown that the phloem region was the path of transmission. So beyond obtaining a few curves of electric responses, Bose, by his very delicate and artfully devised apparatus, has not made any addition to the existing knowledge on the subject. And so long as we possess no information about the electrical conditions in the interior of a plant the positive and negative responses cannot be correctly interpreted. It appears that Bose started his investigation with a preconceived notion that the plants had a nervous system similar to animals and consequently did not follow it with a free mind. If he had not sought to prove that the nervous system of *Mimosa* was similar to that of the animals and had only tried to study the mode of transmission of stimuli in plants he would surely have given to the botanical world some valuable facts on the subject.

The animals are very sensitive organisms and their great sensitivity is due to the very highly developed nervous system. But owing to their habit and mode of life the construction of the bodies of the plants is very simple in comparision to that of the bodies of the animals, and there was no occasion in the evolutionary process to develop such a complex nervous system as Bose supposes. Whenever on account of œcological conditions a need arose for the perception and conduction of an external stimulus to meet certain requirements no special tissue was set apart to meet the demand but that task was performed as an additional or subsidiary function by some tissue in addition to the principal functions discharged by it. The epidermis normally has a protective function but it is well known that in certain plants the epidermal cells perceive the external stimuli and in some plants the cells are structurally modified while in other cases no such structural change has taken place. Such specialization of a tissue which can perform only its normal function or functions, and no other, has not occurred in plants as it is the case in higher animals. The tissues in higher plants as it is observed in the case of injury are many a time called upon to discharge quite a different function than their normal ones. So to term the phloem or the tubular parenchymatous cells of the phloem as the *nervous tissue* is quite incorrect and misleading because the cells of the phloem perform mainly the function of the conduction of food materials.

REVIEWS

BIRD STUDY IN INDIA. By Miss M. R. N. Holmer (Oxford University Press, 1926. Rs. 3).

On p. 541 of vol. xxix of the Journal we welcomed the appearance of a small book by Miss Holmer entitled *Indian Bird Life*. Under the more appropriate title of *Bird Study in India* Miss Holmer has now brought out a revised and enlarged edition of her book, with an introduction by Lt.-Col. John Stephenson, formerly Principal of the Government College, Lahore.

The book before us consists of 148 well printed pages of which however 23 are taken up with introductory matter. The body of the work consists of two parts, Birds of the Plains and Birds of the Hills. Each of these parts is divided into 7 chapters dealing with special aspects of the bird life of their respective areas, though the Chapters of the first part are largely general and introductory in character.

Finally there are three appendices of a systematic nature, culled from the *Fauna of British India Birds*, a short bibliography, and an index.

Miss Holmer says that her aim is twofold, to provide the new arrival in India with an introduction to Indian bird life and a stepping stone to scientific ornithology, and 'to share with others the naturalist's joy in living and beautiful fellow-creatures.'

With regard to her first aim Miss Holmer is at her best when she is painting word pictures of common birds for the beginner. She describes actual experiences and familiar birds with an apt and pleasant pen, and we would gladly have exchanged for more of these chapters the appendices on classification and the pages where she endeavours to explain the various orders. For when she strays into more scientific realms her pen loses its clearness and the gaps in her knowledge become more apparent. Those who desire to study scientific ornithology will not start with Miss Holmer's book; they will probably be beyond the reach of its help before they arrive in India. But there is a vast army of nature-lovers who desire the pleasant easy introductions that Miss Holmer is well able to impart. To them she will impart her joy in nature, for the study of birds is pre-eminently one of delight, and it is on this theme that Colonel Stephenson bases his engaging preface; and it is on this aspect of the book that we dwell with the more satisfaction. Readable nature books are badly needed in India.

A special word of praise is due to Miss Nixon's sympathetic illustrations. Some of them are amongst the best of their kind that we have seen in the success with which they characterize common Indian birds. The Spotted Owlets and the House Crows for instance are excellent. Occasionally however Miss Nixon loses character in a straining after artistic effect and the result then is not so happy. We look forward to seeing more of her work, which might well have been acknowledged on the title page.

H. W.

IN UNKNOWN ARABIA. By MAJOR R. E. CHEESMAN. With a Foreword by Sir Percy Z. Cox. (Macmillan. 25*s*. net.)

Reprinted from the London 'Times', November 28, 1926

The general reader knows enough of the climatic conditions of Arabia to feel no surprise that names on the map between the Red Sea and the Persian Gulf should be few and unfamiliar: the most recognizable word is 'desert,' and that occurs more often than any other; the word Mecca suggests that something in the nature of a religious passport may be demanded of the explorer; and that there are other difficulties may be gathered from 'the meaning smile' accompanying the good wishes of two young Americans who had been told by Major Cheesman that he was leaving Basra for the west to collect birds : 'We hope you'll catch a lot of sparrs' ; the smile implied that political complications would arise if the true purpose of the journey were stated.

But Major Cheesman had told them the truth ; 'sparrs' is not alone the Arabian bird ; there is also *Lusciniola melanopogon mimica* Mad, and that is among the birds he did catch. He was adventuring into unknown Arabia primaririly as an ornithologist ; and, while he was equipped to assimilate such historical, archæological, and geographical information as he could obtain, he had no political or commercial object. He could not have undertaken his journey without the authority of the Sultan of Najd, His Highness Abdul Aziz Ibn Saud, G.C.I.E. ; this he obtained through the good offices of Sir Percy Cox, to whom he had commended himself during the war. Accepted as the Sultan's guest, he travelled without molestation, and as a guest he refrains from all comments that might give offence. There is no discussion of the political matters to which the attention of the world has been attracted in recent years. It is, however, permissible for him to describe the normal life of the Sultan's subjects, and in his pages they are shown as submitting to laws suited to the conditions, and as alive to the peculiarities of other systems. One of them, who had travelled, illustrated to the rest how a London policeman controlled traffic ; students of Shaikh literature will be gratified to learn that a Shaikh is obeyed as promptly as a London policeman.

Major Cheesman made his way from Oquair, on the west coast of the Gulf of Bahrain, to the Hasa Oasis and Hufuf—which do not rank as unknown—and then south to Jabrin through 'a country which is mostly uninhabited and featureless and where no boundaries can or do exist.' In a sense, his geographical discoveries were negative ; he might be said to have flattened out such few features as characterized conjectural maps. Two immense rivers or drainage channels which, under the names Wadi Jabrin and Wadi Aftan, have figured in Arabian maps from the earliest times would have been crossed by him had they existed, and must now be dismissed as mythical. The oasis of Jabrin does exist, for Major Cheesman did reach it—first, apparently, of Europeans to do so—but henceforward it will be no longer what it has been among geographers 'for generations,' a name to conjure with. 'If the northern part may be called 'God-forsaken,' the rest may be called 'God-accursed' :—

Gone were the running streams and the plains teeming with houbara and gazelle. Stripped of all its imaginary glories, Jabrin presented only the remains of an ancient civilization carrying on an unequal struggle against the sand desiccation that was enveloping it on all sides.

It would seem, then, that there may have been a time when the glories were not imaginary. Travellers tell of dead cities in the Sahara, and it is to be inferred that deserts are able to kill because they themselves are alive—and growing. Incidentally, in Major Cheesman's account of his journey we learn how this life is manifested. He says little of his hardships, but he mentions sandstorms repeatedly. One of many genuinely illustrative photographs shows a chalky sandstone hill so eroded by sand that the top looks like a crown on a big cushion ; we read of dunes that move and advance on wells.

Yet there is other life in the desert—a life pallid but vigorous—and it is that with which Major Cheesman, as a field naturalist, was concerned. In the appendices to this book, in addition to geological and meteorological records, there are given lists of mammals, birds, fish, insects, and plants that Major Cheesman noted, and either classified himself or had classified by experts, a considerable proportion of species and sub-species being new. In this connexion it may be added that there are, too, a list of stores required for such an expedition and a large-scale map based on Major Cheesman's conscientious surveys.

For there to be life there must be water, and it is explained both how much and how little there is. We read of wet fogs ; and Major Cheesman expresses his surprise to find below eight inches of dry sand layers of damp sand round the roots of typical desert plants ; in the photographs some of these look luxuriant. One of many enthralling animal stories goes to show that desert creatures possess a specially developed capacity for smelling water ; a wolf knew that it was to be found in a skin bag in a tent. For the layman who will be content to leave Hasa, and Hufuf, and Jabrin as names there is much interesting reading in what Major Cheesman has to tell of the stalking of bats and lizards, and of the daily round of birds, and reptiles, and insects, as well as of his hosts, the men of the desert. The hare would have its form under thick branches that protected it from attack from above; when the party were hunting one hare a fine black eagle joined in the chase—missing its prey, which took cover in bushes at the swoop.

Behind the eagle came a raven, giving a clownlike imitation of all its turns and evolutions, only much slower and getting left far behind.

The desert man spends much of his time looking for lost camels, for he cannot bring himself to take the precautions that would save him the trouble. Hence the quandary of having to send all the force of which he can dispose in search of camels at the moment when the female date-palms are all bursting into flower at once and requiring artificial fertilization. In the desert gratuities are no less a problem than in a town. Major Cheesman mentioned publicly the amount which he had given to an attendant for distribution in order to make sure that it reached the people for whom it was destined.

'On hearing the amount, the Amir gave a gasp, and to this day I do not know whether he was choking at the munificence or snorting with indignation at the meanness of the sum, or merely had hiccough.'

NOMOGENESIS OR EVOLUTION DETERMINED BY LAW. By Leo S. Berg. Translated from the Russian by J. N. Rostovtsow, London, Constable & Co., Ltd. (xviii + 477).

Berg says in his preface: 'I would remind those who may feel indignant at the 'heretical' opinions set forth in these pages, that science should be averse to dogmatism and to a blind reverence to authority.' This is the spirit in which the volume before us was written. No hypothesis is evolved. The author allows the facts to speak for themselves, and all hypothesis inconsistent with them, however precious they may seem, must give way before their force. Berg follows Berthelot's maxim: 'The chief duty of a scientist ought to consist, not in endeavouring to prove the infallibility of his opinions, but in being ever ready to reject an idea that cannot be proved, or an experiment that is unconvincing.'

Berg's book is an original and refreshing production. There is no humbug in his conception of the subject or in its treatment. Plain, uncompromising language, and clear logical deductions characterize every page. The author is a man of vast reading coupled with philosophical training, who is quite capable of utilizing facts of the various domains of natural science and conclusions by old and recent philosophers.

It is impossible in the short compass of a review to give an adequate picture of the variety of conclusions the author has arrived at. To him the struggle for life is a fact that cannot be controverted. But it is not connected, as was thought by Darwin, with the selection of single, best adapted individuals. The struggle for existence is not a progressive, it is a conservative agency; it maintains the standard and restricts variation. The theory of natural selection is generally inadmissible from the point of view of the present doctrine of heredity which shows that individual as well as fluctuational variability possesses no hereditary value. Selectionism would have to prove that the faculty of producing an infinite number of hereditary variations is inherent in living beings. But every biologist knows that this cannot be proved. He rightly concludes: 'Since the struggle for existence does not lead to the preservation of single favoured individuals, but, on the contrary, tends to maintain the standard, all theories of evolution based on natural selection fall to the ground: to such belong not only the theory of Darwin, but also the mutation theory of de Vries and the hybridization theory of Lotsy (1914).'

For Berg the process of evolution is not ruled by chance. This can be judged from the interesting phenomenon of phylogenetic acceleration. Evolution, therefore, is to a considerable degree an unfolding or manifestation of pre-existing rudiments. In addition to such an unfolding of pre-existing rudiments, the formation of new characters takes place. This is due to the effects of the geographical landscape which also transfigures the forms in a determined direction.

Berg finds one of the best proofs of the dependence of evolution upon law, and one of the most convincing refutations of selectionism, in the phenomenon of convergence. Whilst Darwin considers evolution as a process of divergence of characters, Berg ascribes predominative importance to the convergence of characters. He imagines the process of evolution in the following way: 'A considerable quantity, possibly tens of thousands, of primitive organisms have developed on parallel lines, convergently experiencing approximately the same transformations and effecting that process at various rates, some more rapidly, others more slowly. Thus, mammals consist of several branches, every one of which independently passed through the (assumed) worm-, fish-, amphibian-, reptile-like stages. The organic world thus develops polyphyletically.'

From these considerations Berg concludes that evolution proceeds in accordance with laws, that it is based upon nomogenesis (in opposition to chance or tychogenesis). He is convinced of the manifestations of such an accordance with law, but why they should be effected in such a manner and not in another, is concealed from us, and he confesses equal ignorance of the causes by which organisms in general progress in their structure.

We are grateful to Berg not only for having given us a book of profound interest, but also for having acquainted his readers with so much of valuable work done by recent Russian biologists.

E.B.

AN INTRODUCTION TO EXPERIMENTAL EMBRYOLOGY. By G. R. De Beer. Oxford, Clarendon Press, 1926. 148 pages.

The author has tried to select from the vast literature on embryology a number of experiments which, taken together, are intended to shed some light on the essentials of the problems of animal development. The book, though of modest size, embodies some hundred and eighty pieces of work by various experimenters arranged in logical order which give us a plastic picture of the development of the animal body, beginning with fertilization and ending with the assumption of the adult form. He shows the reader how to draw conclusions from the facts obtained by experiment, and very often the process of experimentation is adapted in such a way as to lead gradually to the correct interpretation of the results.

In a final review of animal development De Beer touches on many points which are of more general interest, especially to the philosopher amongst zoologists. He discusses in a few sentences the old controversy as to whether preformation or epigenesis occurs during development. 'Given the initial inherited predetermination,' he says, 'development is a series of processes of differentiation, of producing form where none was, and each stage follows from the previous stage as irrevocably as it is followed by the subsequent one.' This is a clear statement in favour of epigenesis. The author considers the Roux-Weismann theory of mosaic development as untenable. He has to admit, however, that 'cases do occur in which precocious chemo-differentiation of organ-forming substances takes place' and in those cases he regards the cytoplasmic divisions during cleavage as qualitatively unequal and ascribes the mosaic development of the so-called mosaic-eggs to cytoplasmic localization.

When he arrives at the question whether physics and chemistry contain categories of phenomena adequate to explain the behaviour of living organisms or, in other words whether we have to call to help some kind of vitalism, the author becomes very careful in expressing his views on the subject. 'There is no hiding the fact,' he remarks, 'that most of the complex components of development are as yet unintelligible, but by the experimental method the analysis is gradually splitting them up.' Though he seems to expect a good deal from the splitting up of those complex components in the future, he still reminds us that 'ultimately nothing can be really explained,' and he considers it idle and absurd to imagine that experimental embryology will explain the development of organisms.

De Beer's book is not only a useful introduction to experimental embryology, but everybody, even the advanced student, will find it a reliable guide to the 'essentials' of embryology. It is a clear statement of our present knowledge of the subject and free of cumbersome details which, after all, can be of interest to specialists alone.

E.B.

A SHIKARI'S POCKET-BOOK with hints on preserving and skinning trophies in the field. By CHARLES MCCANN, Assistant Curator, Bombay Natural History Society and LT.-COL. C. H. STOCKLEY, D.S.O., O.B.E., M.C., F.R.G.S., F.Z.S. with a foreword by Col. R. W. Burton, I.A. (Retired). Illustrated. 47 pp., 9 text-figures and a diagram. Oxford University Press. Rs. 5.

We recall the instance of a member of this society who sent us, at no considerable trouble and expense the raw and blood-stained skin of his first tiger neatly soldered up in a tin case. But oh when we opened the lid!

The ignorance of the average shikari as to the proper method of preservation of trophies in the field is truly astonishing—the appalling condition of many of the skins sent to museums and taxidermist firms are evidence of this. Sportsmen are usually willing to spend time, thought and money in planning their shooting expedition, but the care of the trophies obtained is usually left to inexperienced skinners, in fact to any one who is willing or seems likely to be able to undertake the job.

The sportsman's duty to his trophy commences from the moment he draws a bead on it with his gun, and the handling of trophies in the field requires a certain amount of knowledge—knowledge which he should have and which he should be able to impart to others. This knowledge the book provides in a plain manner so that all who read may learn. The writer of the book has had considerable experience in the handling and treatment of skins both in the field and the museum and in this book he yields the benefit of his knowledge to hunting men in this country. In addition to Big Game the book includes a chapter on collecting small mammals, birds and one on the collecting and preservation of Butterflies. The book concludes with notes on equipment, camp kit, stores and clothing which will be found useful both to the tyro and the veteran as a glance through the list may prevent the ' leaving behind of several small but important items as boot laces or soap.'

The format of the boook is handy and expressly intended for use in the field—of pocket size, neatly bound in brown canvas, and provided with a game-register and blank leaves for notes and a lead pencil—it is exactly the kind of book that one may carry about easily and we can heartily recommend it to all sportsmen in this country.

Copies may be had on application to the Society. The cost represents a trifling, though sound investment which might be the means of preventing much heart-burning and remorse at the close of a shooting trip.

S.H.P.

EDITORIAL

H.H THE MAHARAJA OF JODHPUR

We are pleased to be able to announce that H.H. the Maharaja Sir Umaidsing Bahadur, K.C.S.I., K.C.V.O., of Jodhpur, has recently consented to become a Vice-Patron of the Society. His Excellency the Viceroy conferred on us the privilege of his patronage last year and Their Highnesses the Maharajas of Cutch, Rewa, and the Maharani of Dhar are already Vice-Patrons and we are glad to be able to add the name of H.H. The Maharaja of Jodhpur to the list of Princes who have already associated their names with the work the Society is doing. His Highness has been pleased to donate a sum of Rs. 5,000 towards the funds of the Society and we take this opportunity of expressing the thanks of the Committee and Members of the Society to His Highness for his generous donation.

Only those who are actually engaged in carrying on the work of the Society can realize how urgent is its need for funds. The Natural History Section of the Prince of Wales Museum, Bombay, is our special province and it is our desire to make this Section worthy of the name the Society holds. Admittedly the space at our disposal in its galleries is small, but such space as we have we intend to put to the most effective use. Our Curator, recently returned from his tour of American and European Museums, is full of ideas and notions for the improvement of the Museum. Must we break his stout heart by an oft reiterated *non possumus ?* Three things are essential to give our plans their fullest effect, money, then money and again money !

GAME PRESERVATION

In our last editorial we commented at some length on the subject of Game Preservation in India. It is a question of more than passing interest to the majority of our members and we hope that those who have anything to say on the subject will not hesitate to let us have the benefit of their views. We have already heard from one member Mr. F. Brayne, I.C.S., of Gurgaon, Punjab on the subject. He writes :—' From what I see and hear during my occa-' sional ventures after big game, I am very depressed with the steady decrease ' of game, and am far from agreeing with the optimistic section of your corres-' pondents.

' I formulated a proposal to a celebrated shikari—now alas dead—several years ' ago of which he heartily approved. He said, however, that he had tried to ' start it but the Forest Department would not agree.

' My idea was to form big-game syndicates and take over blocks of jungle on ' long leases from the Forest Department. The syndicates would be given the ' powers of forest officers for the preservation of game, they would erect their ' own lodges where wanted, appoint their own game keepers, settle what was ' to be killed each season and keep careful records of game and natural history ' notes. They would at all times, of course, give every assistance to the Forest ' Officers and the Forest Officers would naturally help them. As the syndicate's ' interest would be to get as large a stock of game as possible in their syndicate ' preserve, they would combine the advantages of a sanctuary with strong pro-' tection against poaching, wild dogs, and other enemies of game.

' The Forest Officer would, of course, be given privileges when travelling on ' duty in the syndicate's preserves, and he would be in no way the loser. He ' would be most effectively relieved of a duty he probably finds difficult to ' perform with efficiency and would have in the syndicate and its keepers ' staunch and intelligent allies in all his work.

' From the point of view of the sportsman who is posted outside the big game ' country—in the Punjab for instance—it would be an unmixed blessing. He ' would pay a few rupees a month and in return would, when his turn came, 'have a certainty of sport in a minimum of time with a well-known and cut-'and-dried bandobast all arranged for him at the cheapest rates possible and 'the shooting lodge and the keepers at his disposal. The saving in time and 'money, in spite of the monthly subscription, would be enormous and think of 'the comfort and joy of shooting in known jungles with one's own staff to help 'and with one's friends notes on the game, the botany and the natural history 'to read and one's own observations to add.

'Suppose a syndicate of a dozen sportsmen could lease, say, three forest 'blocks for a dozen years at the average sum paid in fees for the last three years 'for these blocks. If each member paid Rs. 20 per month subscription this 'would give Rs. 240 per month for the rent and the game keepers. This would 'probably be enough to carry on with as of course those actually shooting would 'pay special contributions. For the first two or three years probably the 'number of heads to be killed might be rather limited but thereafter with the 'intensive preservation the syndicate would organize, there would be plenty for 'all the members. The syndicate would naturally try and get at least one local 'member in the shape of a planter, Forest Officer or other civil official, so as to 'have a man on the spot to help, advise and supervise the game-keepers.

'Living as I do in the Punjab and finding my big game expeditions most 'uncertain and most expensive I would eagerly join one or more syndicates 'with jungles in the Central Provinces, South India or the Terai. I should 'then be certain of good, cheap, quick sport, which I can never get now.'

'Thinking the matter over, there is another solution which might possibly be 'combined with the one I suggested, and that is the formation of a Game 'Preservation Society with branches in every Province. As its membership and 'resources increased it would with the permission of Government steadily take 'over responsibility for game preservation in Government forests and as far as 'could be arranged in privately owned areas as well.

'The Society would be, of course, just as much Indian as British. Its main 'object will be preservation and only where the quantity and quality of the 'game justified it, would shooting passes be issued to members and, of course, 'the number of beasts to be shot would be laid down for each pass. I think if 'we make a big point of preservation we might get in people not interested in 'big game shooting.'

NATURE STUDY CLASSES

We are glad to be able to state that a beginning has been made with Nature Study Classes for local schools at the museum. Thirteen schools are now co-operating in the scheme and the eagerness with which the courses have been taken up augurs well for its future development.

During his stay in America, our curator had the opportunity of studying various methods adopted by the museums of that country in their very extensive service to the schools. In the introduction to his report on the Educational Work of Museums which we hope to publish later Mr. Prater says 'Perhaps the most impressive phase of museum activity in America is the work done by these institutions for the state schools. The museum has become a vital factor in the educational life of the people and this ideal of service has developed and is developing so rapidly that, with new facilities and a fuller comprehension of the scope of museum responsibility, the museums of the country will become to an even greater degree one of the leading agencies for the cultural development of the nation.'

We have before us as we write a botanical scrap book of spring flowering plants made up by a pupil of the Main Avenue High School, San Antonio, Texas. The scrap book contains beautifully pressed and carefully labelled examples of local flowering plants--a trained museum collector could not have done it better! What, we ask, has been the value of this work to the child? Firstly it has developed her powers of observation—with many of us this power lies dormant but it can be astonishingly improved with exercise—and is it not easier to cultivate precise vision when the objects observed are beautiful and interesting? Secondly, it has widened her interest and turned her natural inquisitiveness into a pleasing channel. Children are naturally curious and this inquisitive interest is the essential urge to reasoned enquiry—it is also the salt of life, for it makes boredom impossible. It is said that one of the troubles of the day is that many people abuse their leisure; this is partly the nemesis of unawakened interest. Thirdly, it has offered the child a problem for independent enquiry, it has taught her how certain discoveries were made, how very little is known and how much she is still able to find out for herself. Finally it has given her a new source of enjoyment—a new appreciation of beauty. For is not her subject beautiful and are not her wild flowers models with never a fault ?

POPULAR NATURE BOOKS

For years there has gone up in India a cry for books on Natural History written in a language understandable by the people. The average scientist scorns the unlearned and though he be polite he cannot refrain from thinking he is casting his pearls before swine if he writes in a manner intelligible to the 'people'. One of the editors remembers on his arrival in India being fired with some enthusiasm on the subject of shells by Mr. H. M. Phipson who pointed out to him what a number of new discoveries in the world of conchology had been made by a neophyte, the late Mr. Abercrombie—a former Chairman of the Bombay Chamber of Commerce and one whose regretted death has caused his son to leave India on what was, perhaps, the eve of his own election to that important office, an office which he would have filled to the great satisfaction of those engaged in commerce in this great city. Fired with Mr. Phipson's enthusiasm and inspired perhaps by leaving a name to posterity which should endure, if children did not, he entered on the subject we may say with zest until the books on conchology reminded him that he was a bad Latin scholar and that *their* Latinity would not improve his classics. A butterfly net and Khandalla turned his attention next to entomology but not even the plates of De Niceville or Moore's *Lepidoptera Indica* could interest him sufficiently to conquer his aversion to the scientific descriptions. Fortunately he had Aitken to talk to and to read, and Phipson for gardens and jungle walks ; but how very badly off the average man in the street in India is in all respects where common books on common Natural History subjects are concerned, compared with dwellers in England or the United States of America.

This Society has already made a good attempt to remove this reproach from India. We have done nothing it is true as regards shells and the common objects of the sea shore, but T. R. Bell, with his interesting life stories, and Col. Evans with those black and white plates and interesting opening pages of what he described as, and what was, 'A Child's Guide to Butterfly Hunting,' and Lefroy's 'Indian Insect Life' have done much for the 'Bug Hunter.' Stuart Baker has done everything for the small game shooter. What an ungrateful man the small game shikari is ! 'We have piped unto you and ye have not danced.' We have put before you the finest illustrated books on the Game Birds of India ever produced. We have given members of the Society such favourable terms of purchase that the bookseller is still groaning and yet we cannot complete the series because members will not buy and will not get their friends to buy. Stuart Baker's books were published by the Society and the Society's money is so locked up in them that further publications by the Society are impossible and we have for other ventures to seek the aid of other publishers.

THE BOOK OF INDIAN BIRDS

The Oxford University Press has a good understanding of what is wanted in the way of popular knowledge literature and when the head of the press in India was shown that wonderful book on American Bird Life issued by the Geographical Society of America he said 'That is what is wanted in India, get on with it and see what you can do with the Education Department in India and if I am not mistaken we shall be only too pleased to publish it for you.' We must apologise if we have not caught his Rabbelais style of diction (he is our Treasurer) but that is the gist and we got our own special artist busy—and a very good artist he is too, though we say it who should not, since we give him his salary,—and we have already produced 150 *coloured* pictures of the *common* birds of India.

In the book these pictures will be arranged four to a plate but we propose issuing the pictures separate from the book and on a larger scale for the benefit of schools and colleges in India. In this case the pictures will be issued in the form of hanging wall charts. There will be roughly 40 species to each chart and 6 charts illustrating about 250 birds will complete the series. We have already received advance orders for 337 charts from the Education Departments of the Governments of Bombay, Madras, Mysore State and Bihar and Orissa, and we are confident that the New Year will wake the other Provinces out of their lethargy and that well over 1,000 copies will be issued in the first edition.

The book itself will be modelled on its American progener. It will be of a handy size and reasonable in price and though it is *the* book which has been wanted for so long its publication will not mean that there is no necessity to buy other books on birds. Buy all you can—so long as you buy the Society's publications—buy the Society's *Book on Birds* but also buy, when it comes out, an illustrated book on birds which is being written by Mr. Whistler with the encouragement of Mr. Frank Mitchell. Buy Stuart Baker's *Game Birds* and then buy *Indian Ducks* written by Douglas Dewar and illustrated by R. G. Wright of the Aitchison College, Lahore. We want more books and we want more support from members.

WANTED A HELMINTHOLOGIST

We would like to draw attention to the advertisement which appears at the beginning of this Journal. The Imperial Institute of Veterinary Research, Muktesar is desirous of obtaining the services of a Helminthologist who will be expected either to carry out independent research or to work in collaboration with others.

The candidate should be a Graduate in Zoology of any recognized University with special knowledge of Helminthology which to the unversed we might explain is mainly the Natural History of parasitic worms.

MASHEER

The Honorary Secretary of the Dehra Dun Fishing Association gives the following interesting information and makes the accompanying request, which we recommend to readers who angle.

' Considering that the Mahseer is a fish which is extremely plentiful in almost every suitable water throughout India, surprisingly little seems to be known of its habits, migration, rate of growth, etc., nor do any systematic experiments appear to have been carried out with a view to studying these. Practically the only method by which reliable data can be obtained is by marking a number of fish over a series of years, recording their weight, date and place of release, etc., and obtaining similar data on their recapture.

To make the experiment a success two points are essential. Firstly marking and releasing of fish must take place regularly over a number of years, and secondly there must be as high a probability as possible of marked fish being recaptured ; and the required information being properly recorded. The first of these essentials has, it is hoped, been secured by the co-operation of the Members of this Association, who have agreed to mark and liberate fish. The second point is, however, much more difficult to secure, for to be of value, waters quite beyond the control of the Association must be covered. The only hope lies in securing the co-operation of as many anglers as possible who may fish in the waters draining into the Ganges and Jumna.

Will any angler who catches one of these marked fish report the capture with full particulars to me at Dehra Dun, U. P. ?

The fish are being marked with a small silver plate, wired through the dorsal fin, and marked with ' D ' and a serial number—D1, D2, etc. The particulars required are

(1) Place of capture.
(2) Date of capture.
(3) Exact weight
(4) Any peculiarities of colouring, etc.
(5) Number of the fish caught.

It would also assist in furthering the scheme if any marked fish re-captured could be released again after these particulars have been recorded.

MEMBERSHIP

This brings us to the subject of membership, and the beginning of a New Year leads us to a review of our forces. How do we stand for man power?—the heart of the Society. Last year we appealed to members to rally round—secure new members and to let the Society's be the last subscription which retirement or income tax caused one to drop. Well, 204 new members appear on our roll—and 97 drop out. The 204 are a gain, the 97 are a loss—Let us hope none of the 97 resigned because the Society was of no use.

The New Year brings with it Honours. May we offer the congratulations of all to two of our regular contributors—Major-General Sir Harry Tytler who has been made a K. C. B. and Col. W. H. Evans, R.E., D.S.O., F.Z.S , F.E.S., who has been given the C.I.E.

ACKNOWLEDGMENTS

Our thanks are due to Capt. L. D. Hearsey, Kheri Lakhimpur, for the help he has given the Society's collector in obtaining a set of skins and skulls of the Spotted Deer for the museum. The group when completed will contain the male, female and young mounted in natural surroundings in accordance with the latest methods of preparation which our curator had the opportunity of studying while in America, and we look forward to associating Capt. Hearsey's name with the case when completed.

FRIENDS IN AMERICA AND EUROPE

The Committee of the Society would also like to express their thanks to those who in America and in Europe helped to make Mr. Prater's visit produce such useful results. Amongst those in America who helped we should specially like to thank the brothers Theodore and Kermit Roosevelt, Dr. Fredric Lucas, the Honorary Director and Dr. George H. Sherwood, Acting Director of the American Museum of Natural History, Dr. G. Clyde Fisher, Educational Department, Mr. Albert Butler, Acting Director and the staff of the Preparation Department and Mr. Lewis Jonas, Taxidermist, Miss Anna Gallup, Curator of the Children's Museum, Brooklyn, Mr. Harold Madison, Curator of the Cleveland Museum, Dr. C. Cummings, Curator, Buffalo Academy of Natural Sciences, Mr. I. T. Frary, Cleveland Museum of Art, Dr. S. A. Barret, Curator, Milwaukee Public Museum, Mr. Stanley Field and the Staff of the Field Museum, Chicago, Mr. Figgins, Director of the Colorado Museum of Natural History, Denver, Colorado, Dr. Van Stræelen, Director of the Natural History Museum, Brussells and the Directors and the staff of the Natural History Museums at Altona, Hamburg, Berlin, Munich and Vienna.

MISCELLANEOUS NOTES

I.—A COMMENT ON 'TIGERS AND ELEPHANTS' AND NOTES ON TIGERS AND BUFFALOES

I am much interested in the article under the heading No. IV 'Tigers and Elephants' on page 514 of vol. xxxi, No. 2, written by R. K. Anderson.

In all the history of Cooch Behar shooting, extending over a period of sixty years, I have never heard of tigers attacking any elephant, tame or wild, unless wounded. And then the tiger has *always* come off second best. The area shot over has been the Western and Eastern Duars and parts of Assam, as you know.

It may interest you to know that tigers very rarely attack full grown buffaloes, wild or tame, singly, and I will give you two instances.

(1) The Superintendent of Pilkhana, Cooch Behar, was going up a river-bed on the borders of Bhutan on a female elephant with other Koonkies, with the object of 'Phadi Shikar' i.e., lassoing wild elephants. Suddenly he noticed a movement in the grass fifty yards ahead. He moved up to investigate, when to his astonishment he saw a magnificent bull buffalo moving along leisurely and on each side was a tiger (probably a tiger and tigress). Every now and then one tiger would dash in to try and get a hold, and the buffalo would merely sweep his horns. The tigers were evidently sparring for an opening. Neither the buffalo nor the tigers took any notice of the elephants which were following. This went on for about half a mile when suddenly one of the tigers got too close, and the buffalo immediately ripped it right up with his horns and the beast died at once. The other tiger did a bolt and the buffalo went on unconcernedly.

(2) The Raja of Gauripur (Assam) was out shooting in Assam and a tiger was slightly wounded one day. It immediately bolted across some open land where a herd of tame buffalo were grazing, and somehow or other got mixed up with them. When the shooting party arrived on the spot there was hardly any tiger left! The buffaloes had actually been tossing it about on their horns as soccer players head the ball to each other.

I believe it is well known that wounded tigers in the Central Provinces are known to have been turned out of a patch by a herd of buffaloes.

Once my father did come across the half-eaten carcase of a wild buffalo, but evidence in the shape of pug marks showed it had been attacked and killed by a pair.

235, LOWER CIRCULAR ROAD,
CALCUTTA.
September 24, 1926.

VICTOR NARAYEN
of Cooch Behar.

II.—NOTES ON TIGER PREFERRING CARRION TO LIVE BAIT

While out shooting in the Central Provinces some time ago, I discovered that there was a very big tiger living in the jungle adjoining my block, and which often came in my jungle, crossing the Mandla-Bilaspur Road at a certain place where the road passed through a bit of thick jungle.

I got a buffalo tied on the roadside but there was no kill for three days. On the fourth day the buffalo died where it was tied owing to some cattle disease prevailing there. The dead body was left where it was and next day I got *khabar* that it was taken away by the tiger. It was traced to a place about 200 yards from the road, where a machan was tied and my friend '.475' sat up in the evening. The moon was only four or five days old and the tiger returned to his feed near midnight. '.475' did not take a chance shot in the hope of getting him on some future occasion. The tiger's eating the carrion we took to be a coincidence; so we kept on tying live bait at the place from where the carrion was first dragged. Seven days passed yet there was no kill at this particular place though sometimes his large and unmistakable footprints indicated that the tiger had passed within a few yards of the buffalo, and as the buffalo was tied in an open place there was no reason to believe that he had not seen it.

On about the eighth day we had to send off the buffalo (which we had been tying near the road) to some other place. A herd had passed by the road in the early morning; S and self went after it and bought two buffaloes from the herdsman.

In order to secure the large tiger we tied both of these near the road, one at the usual spot and the other at a short distance to the left. In the morning both were unable to walk. We now realized that the herdsman had purposely sold us sick animals which he thought would not undergo the long journey. We let them lie where they were and did what we could for them, but the poor beasts died before mid-day. The carcases were left unmoved in the hope of getting a drag.

Sure enough, next morning one of them was dragged by the tiger in question. Another smaller tiger had also visited the place and we naturally took it to be a tigress as it was their mating season then. In the afternoon a beat was arranged which started at about 1 p.m. Within ten minutes the brute was on the move and at first tried to break through the stops on the left, but was successfully kept back by them, and he came towards where '.475' and self were sitting. After coming forward a few paces he immediately changed his course and made for our right. As he seemed to be going straight to a gun posted on our right we let him go. There was a nalla in front of our machans and we saw him go into it but never saw him coming out on our side. It seems he took cover of the nalla and escaped through it. When the beat was within 100 yards of us, out rushed another tiger with deafening roars and came straight towards us at a great pace. A fine shot in the head from my friend finished the animal which turned out to be a tigress. Thus the big tiger had given us the slip for the second time! He was an enormous beast and looked even bigger—at least bulkier—than the 9 ft. 6 in. tiger—between pegs—I had shot there a few days previously.

It is a well-known fact that herds of buffaloes are taken towards Bilaspur from Jubbulpore, Mandla and Saugor districts, and most of them go by the old Mandla-Bilaspur Road. I believe in Bilaspur District they are mostly used for ploughing, hence their great demand. When they are taken in such great numbers naturally a few die on the road, and if one happens to die at a place where the road passes through jungles, the village *chamar* cannot get at it and it is left there to decay or for hyenas, etc. So far I have laid down the facts. But it will not be out of place to surmise that the tiger in question must be taking advantage of this gift of the gods! I have reasons to believe so, because it will be noticed from what I have said that he eventually did drag away our dead buffaloes not once, but on two occasions from the roadside in question.

Has there been any case where tiger has preferred carrion to tied buffalo? I did not try a pig or a donkey as none was available. Will either tempt him? Any criticism or information will be welcome.

A BEGINNER.

[In the *Oriental Sporting Magazine* of June 1874, a writer ('Young Nimrod') maintains from his own experience and on the authority of some eminent sportsmen of the time, including 'Hawkeye' (Capt. Richard Hamilton), 'Zoophilus' (Blyth) and 'Hogspear' (F. Bruce Simpson, B.C.S.)—who was reputed to have shot literally hundreds of tigers,—that tigers prefer putrid flesh to fresh meat, or at least are very partial to it, and will readily eat animals not killed by themselves.

Recent authorities like Dunbar Brander also comment on the tiger's propensity for putrid flesh, and we know the instance of a tiger in the Tavoy District (Burma) who in preference to a live calf that was tied up as bait for a number of consecutive nights close to a village, showed partiality for the dry mouldy bones of a domestic pig that had died two months previously, which were lying in a neighbouring *nullah* submerged in about 18 inches of water. Night after night the beast visited the place passing within 10 yards of the tie. Its *pugs* clearly showed that he had been wading into the stream and pulling out the old mildewed bones which he dragged for about 15 feet on the bank and crunched. The favourite spot to which he always carried this delicacy, was littered with crunched and chewn fragments and it is a mystery as to what the animal could have got from them in return for his pains! EDS.]

III.—BLACK LEOPARDS

The Report of the Honorary Committee for the management of the Zoological Garden, Calcutta, 1925-26, shows that among the animals that were born in the garden during the year were three black leopards which unfortunately died of Gastro-enteritis (verminous) shortly after.

In reply to enquiries regarding the pedigree of these cubs the Honorary Secretary of the Gardens writes under date August 21, 1926, as follows :—

'The three black leopard cubs were born of parents, both of which are black. Previous litters from the same pair also showed melanistic strain. Three more cubs, all black, were born from the same parents in July last and are so far doing well.'

This case is an extremely interesting one. Only in a Zoo is it possible to conduct experiments which will further our knowledge in regard to that peculiar phase in animal colouration known as 'Melanism' and it is to be hoped that the Calcutta Gardens will carry on the good work, occasionally varying the experiment by putting the black male to an ordinary female and *vice versa*.

On page 234 of vol. xvii of the Society's Journal, Lt.-Col. W. B. Ferris records that three litters from a pair of black panthers (2, 2 and 1 cub respectively) which bred in the Kolhapur Gardens, were all quite black like the parents.

It is well known however that black and normally coloured cubs are frequently found in the same litter : T. A. Hauxwell mentions an instance on p. 723 of vol. xv where a litter taken in the Bhamo District (Burma) comprised one black and one ordinary coloured cub. The mother was of the normal type, but it is possible the father may have been of the black variety.

From the fact that neither in the case of the Calcutta pair nor in that recorded from Kolhapur, was there ever a 'throw-back' to the ancestral (?) spotted type, it would appear that melanism is a dominant character. This makes one wonder as to why black leopards are not much more common than they are in the natural state. Can it be that the black colour is in some way vitally detrimental to its possessor in the struggle for existence, and that a large proportion of the animals so coloured fail to survive? Can ferocity, which is usually correlated with melanism, have any part to play in bringing about this end?

BOMBAY NATURAL HISTORY SOCIETY,
6, APPOLLO STREET, BOMBAY.
November 25, 1926.

SALIM A. ALI

IV.—SHIPS' CATS, AND AN INSTANCE OF THEIR HOMING INSTINCT

Our cat 'Tommy' joined this ship in July 1924, at Calcutta. He came from another Company's ship along with his master, who has since gone on leave. I do not know how many ships he has served in, but as far as I can judge he is about ten years old,—a good age for a ship's cat.

The incident I am about to relate took place at Bombay in November 1924, when 'Tommy' went ashore for a stroll, after the manner of all cats. By the time he returned, the ship had left for Calcutta, and of course he was missed by his master and all the ship's company. After discharging her cargo, the ship went to load coal at the Kidderpore Dock. Some few days later another vessel of the Company, also from Bombay, berthed close by. She had brought 'Tommy' as a passenger. He was one of the first to disembark, and made straight for his old home. Since that time he has been careful to take no chances, and now rarely goes on shore. He does not like strangers, and when in port is to be usually found in one of the lifeboats,—only emerging therefrom at meal times. I do not know that the story is worth the telling, as the majority of ship's cats who miss their passage, just board the nearest ship. In this case, by a coincidence the ship 'Tommy' boarded happened to be bound for the same port as the ship he had missed ; and there might be something in cat nature that, seeing his old ship lying close by, he preferred it to his new home as perhaps giving him the better time. Had the ship which he boarded at Bombay been bound to any other port, I expect he would probably have soon made himself quite at home and thought no more about it.

I think ships' cats are different from shore cats, whether this is because they are usually well looked after and fed—in addition to there being a rat or two—I do not know. To make a good ship's cat as much as a good sailor, he must join quite young; otherwise he will take the first opportunity of deserting and not coming back again. Once, however, he settles down to ship's life, and he is unfortunate enough to miss his passage, he appears perfectly content to join the next ship available in preference to living on shore.

The other day while we were lying at Wellington, New Zealand, a very pretty pure bred female cat came up to my deck, and sat down as if she owned the place. Of course I knew she was a ship's cat, and on making enquiries found she belonged to the S.S.——,which had left the port that day. Sometimes we return cats to their ships, when we can, but this one—the only pure bred on board, except 'Tommy,' we 'pinched'; and she lived to have a family by a wharf Tom at Basrah. This Basrah cat by the way 'belonged' to the shed, and gave us the impression that he specialized in marrying ship's lady cats as they arrived. 'Nellie,' as we called the New Zealand cat, was stolen by some boatmen at Alleppey, and her family one by one disappeared, either through cat-admiring boatmen or by falling overboard during their frolics. I might mention that cats of whatever breed are always welcome on most ships. They keep down the rats and besides, are companions.

When we get a cat of low breed, and not quite to our liking, we surreptitiously put him aboard another ship, when the officers are not looking; but this only happens rarely.

Families born on board are all kept. We talk a lot about drowning a few—just to help mother—but when the time comes no one will do the deed, and they are preserved, only for some of them to be drowned afterwards by slipping overboard while at play. Thus nature finds her own way.

S. S. 'Gurna',
Bombay,
October 1926.

JOHN H. HUGHES, M.B.E.
Commander.

[Much ink has been spent on stories concerning thq reputed extraordinary homing instinct of the cat. It is very seldom, unfortunately, that one gets such stories—especially the more remarkable ones—first hand. It is usually A, whose word can be confidently relied on, who tells it exactly as he heard it from his intimate friend B, (a lady whose great fondness and knowledge of animals renders its veracity unquestionable) who when staying at an inn heard the story from the landlady who was personally acquainted with some friends of the people to whom the cat belonged! If a fraction of the tales in circulation respecting the homing sense of the cat were true, this faculty must certainly border on the supernatural, but, there is no doubt that a great proportion of the remarkable returns-home are exaggerations.

In the above instance, however, the strangeness as Capt. Hughes rightly observes, lies not in that the animal having missed its own ship got aboard another lying alongside the dock in Bombay, but that when by coincidence he found this one berthed close to his old home in Calcutta he promptly crossed over to the latter.

It was in all likelihood by sight that Tommy recognized his old home and not by smell which is commonly believed to be the guide. It has been proved by repeated experiments that a cat's power of smell is extremely indifferent. Eds.]

V.—WILD DOGS IN MYSORE

With reference to Capt. Windle's letter in vol. xxxi, No. 2 of the journal; I shot wild dogs out of seven different packs in this district last year and have seen many others at various times. Their colour varies from light golden to brown-red, but all that I have seen in this district whether on the plateau or in the Wynaad have had not only a black tip to the tail but black on its upper side for practically its whole length. Down near sea-level the colour is lighter, the tail much less bushy and with a blackish tip only. The above is confirmed by Mr. E. J. van Ingen, our local taxidermist, who states that in his experience the South Indian wild dog always has the black tip.

I am sending you under separate cover four skins in case they may be of interest;

(1) Full-size dark skin with black bushy tail—this is the ordinary type of the district. Shot at Anaikatti in February, 1926.

(2) Full-size lighter skin with narrow tail and little black on it. Shot on the Tellicherry Ghaut in Malabar in October, 1925.

(3) Small-size dark skin (without head)—half-grown dog shot at Mudumalai in May, 1925. A full-grown dog was with it crouching in the ditch but was not seen in time.

(4) Small-size light skin (with head) marked 520—shot at Mudumalai in April, 1925 out of a pack of eight or ten *all of small size*. The dogs were running towards the fire-line we were on and seeing us stopped and stared some thirty yards off. I noticed at once that they were small and looked the pack over carefully before opening fire to see if there were any full-size dogs, but there were none. I was surprised to see a pack of what I then presumed to be immature dogs running on their own account (I had met a pack of three full-grown and two small dogs at the same place a fortnight before), but after reading Capt. Windle's letter have begun to wonder if these may not have been a smaller kind of mature dog. Unfortunately only one of this pack was bagged, and with the skin I send the skull together with a full-size ordinary skull for comparison. From this you will, no doubt, be able to decide if the smaller dog was mature or not. To me it appears mature.

As regards the noises made by wild dogs—a whistle is the usual form of communication and is generally used to call the pack together when they have got separated as the result of firing. They occasionally whine or whimper and I have twice heard them yap. I have never heard them bark, but the well-known Nilgiri sportsman, the late Genl. Hamilton ('Hawkeye') writing in 1876 mentions that a wild dog which he had fired at, and missed, near Avalanche, 'only retreated a short distance and then rushed back tail erect and barking furiously.' Two more long shots also missed and the dog then decamped 'barking for some time after he disappeared.'

C. E. M. Russel (*Bullet and Shot in Indian Forest*) mentions two cases of aggressive behaviour by wild dogs towards men, and Col. Pollock (*Sporting Days in South India*) states that they will sometimes kill *helas* (buffalo calves) tied out as baits for tiger. A case of the latter occurred last June at Masinigudi when two sportsmen were sitting up in a machan over a live heifer. A pack of wild dogs appeared and attacked the heifer which was only saved by the sportsmen opening fire.

Why is it that old-time sporting writers so seldom mention wild dogs? Were they considered beneath notice, or was it that they were much scarcer then?

Since writing the above, I have been down at Anaikatti, and have made enquiries on the point raised by Capt. Windle. My shikari, Jaora, a reliable man, stated positively that there are two distinct kinds of wild dogs. He said that the larger kind only were found south of the Moyar River, but that a smaller kind hunted in Mysore to the north of the 'Ditch'. The latter he described as similar in colour to the larger kind but with a light patch on the head. He said they were much fiercer, very destructive to sheep, and would not hesitate to attack man, which the larger kind never did. They were to be found round Bachhalli and Bandipur—the latter place is only a few miles from Mudumalai of which Capt. Windle writes.

Of course this is merely hearsay, but I have always found Jaora's statements reliable.

I hope to be able to visit Bachhalli next month, and will then make further enquiries.

Lovedale, Nilgiris. E. G. PHYTHIAN-ADAMS,
October 23, 1926. *Major I.A. (Retired.)*

[A careful examination of the skins and skulls submitted by Major Phythian-Adams has convinced us that they all belong to one species of dog only, viz., *C. dukhunensis*. The apparent differences are doubtless due to age and to the different times of the year at which the specimens were obtained. For instance No. 1 which was shot in winter (February 1926) naturally shows a better coat than No. 2 shot in October where it would be just preparing for the partial seasonal change.

Nos. 3 and 4 are obviously immature animals. In the skull of No. 4 milk teeth are present, the fusion of the cranial sutures is incomplete, and no dorsal ridge appears. Eds.]

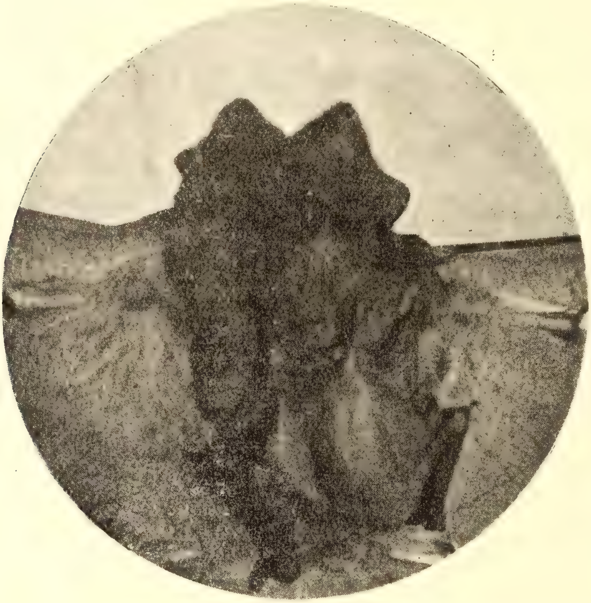
VI.—NOTES ON THE LONG-ARMED SHEATH-TAILED BAT *TAPHOZOUS LONGIMANUS*, HARDW.

(*With a photograph*)

A few of these bats were caught by me living in the niches on the outside of the Prince of Wales' Museum dome, of which three were males and three females. This would go to show that the sexes in this species live together.

All the three males were much lighter in colour than the females, being a yellowish brown; the females on the other hand were dark blackish-brown, almost black. Blanford, in the *Fauna of British India,* mentions that Blyth observed the young individuals to be pale fulvescent and that they became gradually black with age. Whether these paler ones were males or females he does not say, for they might have all been males? One male taken by me at Vihar Lake the day before was even paler than those secured in the Museum, being of a very pale fulvescent tint.

On looking through the material in the Society's collection I found this difference in the sexes to be the general rule, only a few being like the females which are probably young spcimens. One at least is very young and is coloured like the female. In almost all cases I could pick out the males from the females by the difference of colour alone.



Of the three females mentioned above, secured in September of this year, two were in an advanced state of pregnancy and, from all appearances, the fœtus (of which there was only one in each case), would have been born in a couple of days. The third had a young one clinging to her, as shown in the photograph.

Blanford states that a pregnant female was taken in early August in Calcutta, the present record would therefore extend the breeding season slightly, although no mention is made of the condition of his fœtus.

The young one, a male, was almost devoid of hair. It attached itself to one teat and would not easily relax its hold though it would change from one teat to the other occasionally. Young as it was, it showed the tendency of hanging head downwards, as when I turned the mother round it would alter its position and when I repeated the experiment it turned round again always hanging head downwards. The wings of the young one were imperfectly developed near the margin of the 'hand' region. They were very tender and showed no clear-cut edge as in the case of old ones (they may have been damaged). The wings were covered with a sticky oily substance, especially in the folds.

The same author says that this species is probably a cave dweller and inhabitant of rock fissures; it is frequently found in old temples, cellars, and outhouses, etc., and that Blyth once observed it on the stem of a palm. My observations confirm this last statement, as the one secured at Vihar Lake was shot on the stem of a *Borassus* or 'Tadgola' palm. Referring to the specimens in the collection, I notice that Mr. Crump, one of the Society's collectors, found a bat of this species on a palm in Chanda, and Mr. Phillips, from Ceylon, also quotes two instances of his having secured specimens in the crown of coconut palms. There is also another statement made by Blanford which I wish to confirm, viz., that individuals in confinement can cling to vertical smooth surfaces and creep by means of the claws. As a general rule such progression is backwards and at an angle when on a flat or upright surface. When disturbed while hanging they move very quickly to either right or left as the case may be.

There are two noises usually produced by this species. One is an almost inaudible repeated 'tic-tic-tic,' etc., uttered when they are hanging together and the other a harsh screech uttered when caught or alarmed.

Bombay Natural History Society,
6, Appollo Street,
November 1, 1926.

C. McCANN

VII.—THE BREEDING OF THE INDIAN RHINOCEROS (*RHINOCEROS UNICORNIS*) IN CAPTIVITY

The following are some particulars kindly supplied by the Honorary Secretary of the Zoological Gardens, Calcutta, relating to a calf of the great one-horned Rhinoceros born in the Garden on October 9, 1925, which are interesting. Unfortunately the birth was somewhat premature and the calf survived a few hours only.

So far as could be ascertained from the Keeper, mating commenced on March 17, 1924 and continued till the end of that month. The period of gestation would therefore appear to be about nineteen months. Hodgson with his seventeen or eighteen months is therefore much nearer the mark than Desmarest who estimated it as under nine months!

The weight and dimensions of this calf are given as follows:—

(1) Body weight when born	74 lbs.
(2) Length of head and body	3′ 2″
(3) Length of tail	9½″
(4) Height at shoulder	1′ 11″

Hodgson gives the following measurements of a newly born animal of this species:—

Length (excluding tail?)	3′ 4″
Height	2′ 0″

and B. C. Ellison records the dimensions of a fully developed fœtus taken from an animal shot during H.R.H. the Prince of Wales's shikar in Nepal, as under:—

Head and Body	3′ 4″
Tail	9″
Girth	2′ 9″
Weight	120 lbs.

It will be seen how closely the measurements agree in the case of all the three calves, and it might therefore be safe to accept them as average of a new-born calf.

Bombay Natural History Society,
6, Appollo Street,
November 22, 1926.

SALIM A. ALI.

VIII.—EXTENSION OF HABITAT OF HUME'S SCIMITAR BABBLER (*POMATORHINUS HORSFIELDI OBSCURUS*) TO ORISSA

While going through the Society's Bird Collection recently I came upon a specimen, obviously of this race, obtained by Major H. J. Walton, I.M.S., at Rosul Hindol, Orissa, on February 18, 1902. On page 211 of vol. i, *F.B.I.* Birds (second edition) it is stated, 'So far only recorded from Mt. Aboo and Seoni.' As Orissa is considerably farther east of the localities mentioned, I think this record is very interesting. Major Walton gives the following data regarding the specimen on his label: 'No. 1418♂ Long tot. = 9.5", al. = 3.8", caud. = 4.1", culm. = 1.25", tars. = 1.3". Iris deep red. Bill yellow: base of culmen blackish. Legs and feet olive-green. Testes moderate.'

The specimen, which is numbered 850 in the present catalogue, is much paler than true *horsfieldi horsfieldi*.

It would be of great value if members sent us skins of this race obtained outside its known range.

Bombay Natural History Society,
6, Appollo Street,
October 1, 1926.

SALIM A. ALI.

IX.—INDIAN CUCKOO NOTES—KOEL (*EUDYNAMIS S. SCOLOPACEUS*) PARASITISING NEST OF INDIAN ORIOLE (*ORIOLUS O. KUNDOO*)

It is well known that the Indian Koel lays its eggs in the nests of the House Crow and rarely in that of the Jungle Crow. I was not a little surprised when on May 25 I found a koel's egg deposited in the nest of an Indian Oriole (*Oriolus o. kundoo*, Sykes). There were three oriole's eggs and one koel's egg. I do not think this has been recorded previously, and I think it is due to untoward circumstances—to the fact that the Koel at the time she deposited her egg was unable to find a suitable nest and so dropped the egg into the nearest likely nest available to take its chance. This is to some extent borne out by circumstances for koels are very plentiful in the vicinity of this oriole's nest while the nearest crow's nest was about two or more miles away.

I have also been sent an egg from Secunderabad which was found in the nest of an Ashy Wren-Warbler (*Prinia socialis socialis*) on September 21, which is quite unlike all described eggs of *Cacomantis passerinus* and those figured by E.C. Stuart Baker in his article[1] on the Oology of the Indian Parasitic Cuckoos. This egg is almost identical in colouration and size to an egg of the Jungle Wren-Warbler; it measures 18.3 × 13.2 mm. This is the second time my correspondent has found this egg in the nest of an Ashy Wren-Warbler and the latter seems to eject the cuckoo's egg from its nest. He notes as follows:—

'First Nest of Ashy Wren-Warbler

16—8—1926. Nest completed and first mahogany red egg deposited.
17—8—1926. Nest completed and second mahogany red egg deposited.
18—8—1926. Cuckoo's egg deposited.
19—8—1926. Cuckoo's egg disappeared, two red eggs only in nest.
30—8—1926. One red egg hatched.
31—8—1926. Second red egg not in nest.
10—9—1926. Young bird quitted nest.

Second Nest of Ashy Wren-Warbler (perhaps the same pair).

17—9—1926. Nest completed.
20—9—1926. First red egg deposited.
21—9—1926. First red egg and one cuckoo's egg, latter removed and sent to Mr. D'Abreu. This egg similar to the one that disappeared from the first nest.

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[1] *Journal B.N.H.S.*, vols. xvii and xviii.

22—9—1926. Second red egg deposited.
4—10—1926. Both red eggs hatched.
14—10—1926. Both nestlings left nest.'

It would be interesting to know if any of your correspondents have had any experience with this cuckoo which lays its egg in the nest of the Ashy Wren-Warbler and to whose egg its has not the slightest resemblance.

Central Museum,
Nagpur, C.P.
November 11, 1926.

E. A. D'ABREU, F.Z.S.

X.—OCCURRENCE OF THE WOOD SNIPE (*GALLINAGO NEMORICOLA*) IN BURMA

Referring to the *Indian Game Birds,* vol. ii, I see that only once previously has the wood snipe been recorded from Burma and curiously enough from the same district—Myitkyina.

While moving from one snipe ground to another on October 24, my dog flushed what I took to be a wood-cock. I followed the bird up and after great difficulty, fully ten minutes' hard work by the dog in a small patch of scrub jungle only 20 yards square, he flushed the bird again and I bagged it. On the dog proceeding to retrieve the bird he flushed two more and I stood in one spot and bagged five. The other guns only flushed two birds and bagged both.

They appeared to just fancy this spot as with eight coolies extended over a line of 60 yards we put up no more birds, giving us in all three and a half couple. It is the first time I have shot the bird though I recognized it from the plate and description in volume ii, *Game Bird of India, Burma and Ceylon.*

I am sending two sets of wings to satisfy you and write you this account as a matter of interest which might be worthy of the next Quarterly Journal. The ground we found the birds on was covered with very thick grass about 3 feet high with water 4 inches deep, with small mounds dotted about and scrub jungle and grass growing on them. The birds were between these mounds—most unsuitable land for snipe (Fantail or Pintail or even the Painter).

Sahmaw Estate, Myitkyina District,
U. Burma.
November 4, 1926.

A. MACDONALD.

[The wings undoubtedly belong to the Wood Snipe (*Gallinago nemoricola*). Eds.]

XI.—ARRIVAL OF SNIPE IN MYSORE

It may be of interest to members to learn that I shot three Snipe (Pintail) in the heart of the Malnaad of Mysore on Sunday, August 29.

The S.-W. Monsoon is still on here, although lighter than usual. It is not due to leave us till September 15 approximately. We have averaged 35 cents a day the last week.

I had visited the swamp in which I shot these three (the only ones there) about the middle of July and on August 22 and found none. Of these three birds two appear to be young birds. Many planters assert a few Snipes remain here all the year round, but I have never observed this and I think that it is generally agreed that those that do stop must be 'pricked' birds unable to undertake a long journey.

I believe (I have not a copy at hand) in the *Game Birds of India,* vol. ii, the migration chart shows the arrival of Pintail in Mysore as the beginning of October, and the Fantail, beginning of August? I do not think the Fantail visits the Malnaad of Mysore at all, but I dare say it is found near Bangalore, where also, no doubt, snipe arrive earlier and in greater numbers.

Guntanaik Estate, Balehonnur P.O.,
Kadur District.
August 30, 1926.

G. V. R. FREND

[The approximate dates of arrival of the Pintail and Fantail Snipe in Mysore as shown on the migration maps in vol. ii of the *Game Birds of India, Burma and Ceylon* are October 5 to 20 and September 25 to 30, respectively.

Writing again on October 2, Mr. Frend says :—

'I am afraid I was unable to find time to visit any more Snipe swamps 'till September 26, when I again visited the swamp in which I had shot the 'three Snipe on August 29. However, it will probably be of interest to you 'to hear I found no sign of Snipe then (September 26). Since then I visited 'another small swamp, but did not see any trace of them.'

From the fact that no Snipe were seen on September 26 either on the same swamp or subsequently on the other one visited by Mr. Frend, it would appear that the three birds obtained by him about the middle of July, as also those shot on August 29, were all 'stay backs' of the last season. The fact that two birds of the latter date were apparently young supports this presumption. Eds.]

XII.—MIGRATION OF WILDFOWL

I give below a short account of the ducks which were ringed in February 1926, on different tanks in the State.

You know that His late Highness Maharaja Sir Udaji Rao Puar Sahib Bahadur had ordered some rings from you for putting on ducks in January last, with the idea of finding out their permanent homes and whether these very birds come back to the same localities.

The birds were accordingly ringed in February almost at the close of the season, and it will be seen from the following accounts received from time to time that these birds go back as far as Siberia, from Central India, in about three months' time.

The first duck, bearing ring No. 29, a White-eyed Pochard (*Nyroca rufa*) has been shot by Lieut. W. A. Gimson, R.A., on Lekoda Tank (just north of Fatehabad, near Ujjain) in the month of March 1926, in Gwalior Territory.

The second duck (No. 94), a Wigeon (*Mareca penelope*) was shot by one Mohamad Akbar of Campbellpore in the beginning of May last year, at Jand Station, on the N.W. Railway.

One Bag Ali Shah, Head Constable, Railway Police, Jhind, shot one of our ducks in Jalwal Village (Attock District) on April 5, last.

The last one (No. 58) a Pochard (*Nyroca ferina*), male, has been shot by some one, at a distance of 120 kilometres from the town Barnaul, in Siberia, in the month of May last and this information has been kindly sent by Prof. Hermann Johnsery of Tomsk University.

The duck season has now commenced and it has to be seen whether some of the ringed birds come back to India again.

I am sending this account with the hope that it will interest the readers of your well-known Journal.

Private Secretary's Office,
Dhar State.
October 30, 1926.

G. B. PAURI,
Private Secretary to
H.H. The Maharaja of Dhar.

[As far as we are aware this is the only experiment of its kind made in India that has yielded results. We supplied in all 500 aluminium rings inscribed 'Inform Maharaja of Dhar' to the late Maharaja in January this year, of which about 200 were used on birds. The percentage of recoveries in this short interval works out to two per cent. which is certainly encouraging.

Landsborough Thomson in his interesting, recently published book—*Problems of Bird Migration*—estimates that about two or three per cent is a common figure for total recoveries, but the proportion may be less, sometimes much less, than one per cent in the case of some of the smaller Passerine birds. Ducks give high figures and Mortensen obtained twenty per cent with Pintail, which as the author observes, is remarkably good when it is considered that most of the reports came from a distance.

We confidently expect more recoveries to be reported in the case of the Dhar ducks. In India where the major part of our wildfowl is migratory, this mode of experiment deserves to be tried on a much vaster scale, and we hope the success achieved in the above case will be an incentive to other sportsmen and naturalists to employ similar methods.

Many problems still remain to be solved concerning our migratory wildfowl, and it is only by such means that we can hope ultimately to arrive near anything like a solution. Eds.]

XIII.—THE BREEDING OF THE INDIAN LESSER WHITETHROAT (*SYLVIA CURRUCA AFFINIS*) AT QUETTA

With reference to 'Some notes on the second edition of the *Fauna of British India*—Birds, vols. i and ii' by Claud B. Ticehurst which appeared at page 497, vol. xxxi, No. 2 of the Journal, published on August 15, 1926, regarding the nesting of the Indian Lesser Whitethroat (*Sylvia curruca affinis*) at Quetta, I would like to make the following statement:—

About ten years after I had left Quetta, Dr. Ticehurst wrote asking me whether I was sure that this bird nested at Quetta. I told him I was not. At that time, I had not access to my notes, which I have at the time of writing this. On referring to them, I find that May 13, 1906, so far as finding birds new to me, was a red letter day. On that day, I found the nests of this bird, as will be explained later, the Eastern Orphean Warbler (*Sylvia hortensis crassirostris*) and the Rufous Shrike (*Lanius cristatus phoenicuroides*). I had not seen these birds before, so did not know what they were, consequently I had to do, what is always distasteful to me, shoot them off the nest. This I did and sent them to the museum for identification. They may have been wrongly identified. As the Shrike and Orphean Warbler have not been challenged, I do not see why the Lesser Whitethroat should be? I am afraid the reason why Dr. Ticehurst could not obtain information from the Museum was probably due to the fact of the skins being such bad specimens, were thrown away, not being worth preservation. The eggs, I took, were not marked till I received a reply telling me what they were. The following is an extract from my notes:—'13—5—1926. Nest in low thorn bush, 4 incubated eggs, nest flimsy.' I found another on May 31, with four half-fledged young, and seem to have found five or six Orphean Warblers.

The eggs are now in the possession of Mr. Stuart Baker, who should be well able to express an opinion as to whether they are the Indian Lesser Whitethroat, if not, what he considers them to be.

Quetta is a highway for migrating birds and it is not beyond the bounds of possibility that a bird, here and there, may be compelled, by circumstances, to stop and nest before reaching its destination proper. The locality, in which the Whitethroats' and Warblers' nests were found, was on the hillsides bounding the Hanna Pass and not in the valley.

It is to be hoped that ornithologists who may happen to be quartered at Quetta now, or in the future, will keep an eye open for this bird.

CAPE TOWN, R. M. BETHAM,
October 30, 1926. *Brigadier-General.*

XIV.—THE EFFECTS OF A RECENT CYCLONIC STORM ON BIRD LIFE IN KARACHI AND ITS ENVIRONS

The rainfall in Karachi for the past seventeen years works out to an average of 6.54 in. per annum. These figures however include abnormal falls of 9.28 in., 14.12 in., 8.08 in., 20.33 in., 12.63 in., and 15.54 in. during the years 1910, 1913, 1914, 1916, 1921 and 1926 respectively.

The actual rainfall in seven of these seventeen years has not gauged 3 in. per year, so when Karachi, situated as it is, was suddenly struck by the cyclone and deluged by a more or less continuous downpour, gauging 12.71 in. in so short a time as 38 hours, the results can be imagined.

On the evening of Saturday, September 4, rolling banks of dense clouds overshadowed the sky completely shutting out the sun, then came the wind and rain bringing desolation and destruction.

By Sunday afternoon roads and streets were muddy, sluggish waterways, dotted here and there with uprooted trees. Maidans and recreation grounds, sheets of water, and the Lyari (a dry river-bed) a rushing, swirling, ugly-looking torrent, scattered with floating debris, the washed-out homes, all the worldly possessions of many a Mekrani family; here or there, turned and twisted by the remorseless current, almost submerged but still distinguishable, the carcass of some unfortunate domestic beast, the bloated body of a rat or a mass of drenched, bedraggled feathers, a mere shape, all that remained of some hapless bird, alive so shortly before, realistic, grimly symbolic of the insatiable rage of the elements.

Monday dawned, the wind and rain had gone leaving a trail of havoc. Distress and disease, malaria, typhoid and dysentery, quickly followed taking toll from every street. Karachi is still suffering, doctors and undertakers profiting.

. . . .

The cyclone came at a time when the house crows had still the responsibilities of feeding their hungry, helpless, half-fledged offspring, consequently, as a 'species', they suffered heavily.

Over a score of dead fledglings, apparently beaten out of their rain-and-wind-battered nests, were counted in the compound of the Civil Hospital alone and in two small public gardens within the limits of the city proper. Heaven alone knows how many had been washed away before the floods subsided, but it is significant that, about twenty days after the cyclone, only four young crows were found in the fields at Malir and Landhi, where in all about eighty birds were seen.

While the storm was at its worst a crow which attempted to fly from a date palm to a 'banyan' tree a short distance away, was beaten down by the rain. It managed however to flap and flounder its way out of the water and sought safety under a building stair-way. This bird which was fully grown was quite exhausted and incapable of flight.

The city house sparrows, like the kites and semi-domestic pigeons of the town, were able to find shelter in buildings, on cornices and under the eaves of roofs, thus escaping the violence of wind and rain. On the whole the kites and pigeons got off lightly, with just a severe drenching, the sparrows however suffered to some extent.

During a short lull on the evening of the second day a batch of pigeons ventured out to feed in the yard of a granary, but after circling around, flew off towards the city without attempting to alight on the sheet of water below, their transformed but regular feeding ground.

If the floods had not subsided as quickly as they did, it is probable that all species, habitants of the city and its environs, would have suffered more or less from starvation. It would then have been interesting to note if any of these species migrated temporarily elsewhere.

A pair of rose-ringed parroquets took shelter under the gable of our roof and a pair of house mynas jostled a pigeon for room under the eaves.

A flooded-out earth mole swam to a partly submerged *kutcha* wall, upon which it climbed, crawling feebly from end to end vainly seeking shelter and safety in some hidden recess.

Kites and the pigeons sat, in some instances, almost side by side for hours on sheltered cornices.

Human bodies and the carcasses of camel foals, cows and donkeys, washed down by the Lyari River, were fished out of the sea at Keamari. The story goes that some cows pulled out alive by Port Trust employees were milked shortly after landing, poor beasts.

. . . .

On September 25, about twenty days after the cyclone, a searching visit was paid to the gardens and other wooded tracts at Malir and Landhi, thirteen and fifteen miles respectively from Karachi, where bird life abounds.

A 'babul' wood situated between these two places had apparently met the brunt of the storm. The position of uprooted trees clearly indicated the direction of the wind, which struck the wood from the west, moving in a semi-circle towards the south, leaving in its wake rows of torn and uprooted trees. Here alone, within a comparatively small radius, could be counted over a score of fallen trees.

This wood is the haunt of many drongos and several species of Shrike, but none of these birds appeared to be in less numbers than usually met with.

A small but dense belt of tamarisk scrub, near the Malir River, a favourite resort of common babblers and some warblers was entirely devoid of bird life.

Large mangoe, mulberry and guava topes, which usually contained great numbers of white-eared bulbuls and white-browed fantail flycatchers, were found practically empty of bird life, the two species named being conspicuous by their absence. In all, three of the former and only one of the latter were seen.

Extensive bean and egg-plant fields, the usual haunts of numerous tailor birds, were quite deserted. A quiet beat along the bushes, row by row, flushed a single bird which appeared weak and sickly.

These very fields once yielded no less than nine fresh nests in a short and casual search.

Irregular tracts of small 'babul' trees and borrow-pits along the railway lines, where doves, pin-tailed munias and bee-eaters were usually found in abundance, had been apparently quite submerged and very few of these birds were seen.

As a result of such observations, as were possible under the circumstances, it can with safety be said that as 'species' the smaller Warblers, White-eared Bulbuls and White-browed Fantail Flycatchers suffered the most, the Babblers to a less degree.

The heavy toll among crow fledglings was due more to circumstances, than to direct results of the cyclone, which came at an unfortunate time, when the young birds, exposed and helpless in open, unprotected nests were at the mercy of wind and torrential rain.

The shrikes and drongos being larger and constitutionally stronger than flycatchers and warblers apparently escaped scot free. Such is the insuperable Law of Nature, what the strong survive the weak succumb to.

Note.—Unfortunately, photographs taken during the cyclone proved failures, owing to the extremely bad light.

KARACHI, SIND. K. R. EATES.
October, 1926.

[Mr. Culbertson writes from Karachi on September 13, that quail were arriving during the storm. A friend of his picked up a quail in his drawing room and put up another in his garden on Monday morning just after the storm had blown itself out. He appears to be of the opinion that much more damage was actually caused to animal life by the heavy rain and overflowing of nullahs, etc., than by the wind which did not reach beyond forty or forty-five miles per hour. EDS.]

XV.—STRANGE BEHAVIOUR OF A TRUNCATED FLY

Some time ago, seeing a large fly, like a horse fly, sitting on a tumbler, I absent-mindedly took up a knife and, by a lucky hit, cut it at once in two in rear of the front legs. Instead of finishing the fly's earthly career it led to a most amazing performance on the part of the fly, which continued until I could stand it no longer and took further measures.

The two halves of the fly appeared perfectly well, vigorously chased each other about the table and indulged in several very severe fights. The hind part appeared to have intelligence as well as the front part and was quite equal to holding its own in the fights, having the advantage of weight on its side.

I do not know how long apparent life would have lasted but I watched the performance for about twenty minutes and then stopped it.

What is the explanation of both halves being able to carry on independently? I can understand the head-piece existing for a time but is there a separate mental organization in the body or is it merely very vigorous and continued reflex action?

ELGIN HALL,
DALHOUSIE. C. W. SANDERS,
July 20, 1926. *Major.*

[Commenting on the above Major R. W. G. Hingston writes as follows :—

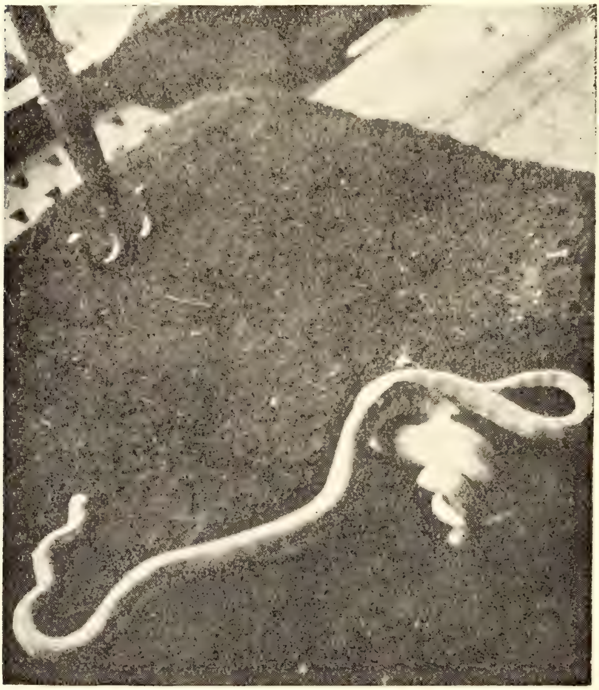
'The nervous apparatus of a fly consists of a brain, a sub-œsophageal ganglion, and a ventral chain of ganglia along the floor of the thorax and abdomen. The brain is the central organ of sensation ; but each ganglion of the ventral chain is capable of individual nervous control. It possesses both motor and sensory functions, is an independent reflex centre, exhibits a capacity for co-ordination with some degree of individual autonomy, and this co-ordination exists independently of that exercised by the brain.

Referring to Major Sanders' experiment. When the fly was severed behind the front pair of legs its nervous apparatus was divided into parts. The brain, the sub-œsophageal ganglion and probably the first thoracic ganglion went with the head half. The remaining thoracic ganglion, and all the abdominal ganglia went with the posterior half. Each half, therefore, possessed a nervous apparatus efficient for both motor and sensory functions together with some capacity for individual behaviour. Major Sanders states that the halves appeared perfectly well. Such a result might have been anticipated, a brainless insect can be induced to eat. A decapitated Ichneumon can clean its wings, if the prothoracic ganglion be isolated by severing the connectives in front of and behind it, the forelegs will still respond to stimulation.

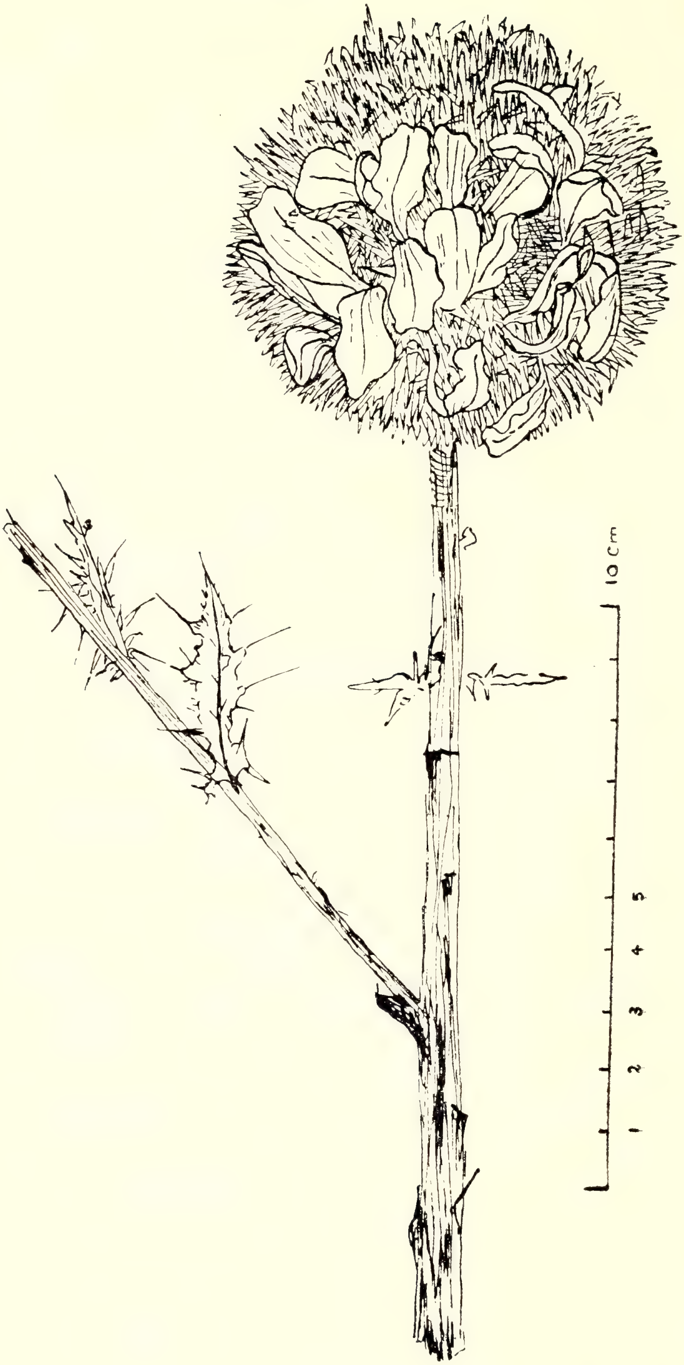
But Major Sanders goes further. He writes that each half appeared to have intelligence, that they chased each other about the table and indulged in several severe fights. This conclusion cannot be admitted. Many entomologists deny intelligence even to complete highly-organized insects; and such can scarcely be admissible in a brainless posterior half. No doubt a reflex activity was excited when the two halves came into contact; but such behaviour cannot be regarded in the nature of a conscious or intelligent rivalry.' EDS.]

XVI.—THE PAIRING OF SEA SNAKES

(*With a photo*)



I am sending you a photograph of two sea-snakes which we caught at Dabai in the Persian Gulf, last April. We saw these snakes locked together in the water, so another officer and myself went off in a boat and captured them. We lifted them out of the water on the end of a boat hook, carried them on board and put them on the dock where I took the picture, and yet they never let go of each other, although they were both very much alive. It appeared to us that they must have been engaged in sexual intercourse to show such indifference, but even so one would hardly have expected such shy creatures to take no notice whatever of handling. Any remarks which



VIVIPARITY IN A THISTLE

you may have to make on this subject will also be greatly appreciated. The picture shows the snakes in the state in which we took them from the water, they being both alive when the photograph was taken.

R.I.M.S. 'Lawrence,'
R.I.M. Headquarters,
November 28, 1926.

A. R. POYNTZ.

[With regard to the copulation of snakes in general, G. A. Boulenger (*The Snakes of Europe*) writes as follows :—

'The union of the sexes sometimes lasts only a few minutes but usually 'an hour or more; it has even been observed to last a whole day. Several 'copulations may take place at intervals of a few days. . . . The more or 'less prehensile tail with which thoroughly aquatic snakes (like sea snakes) 'are provided is no doubt of use in facilitating the pairing when it has to 'take place in the water.'

All exclusively aquatic snakes such as the *Hydrophiinæ* are ovoviviparous and thus dispensed from going on land for parturition. Eds.]

No. XVII.—OCCURRENCE OF THE WORM-LIKE BATRACHIAN *ICHTHYOPHIS MONOCHROUS*, Bouleng., AT KHANDALA, POONA DISTRICT

When at Khandala during the month of September 1919, I secured several specimens of this Batrachian. It lives under stones, during the rains, in burrows much after the fashion of the earthworm which it also resembles in its movements. At first sight it might well be mistaken for one of these creatures as its body is also coated with slime. On the removal of the stone under which it lives the animal soon begins to descend into its burrow away from light.

It was only by chance that I picked up one of these animals while hunting for other things. It was its darker colour which arrested my attention first. When I examined it more closely, I discovered that it possessed a definite head and jaws like that of a snake and as I had never seen an animal like it before I consigned it to my collecting bottle for examination later on and was glad to find then that I had discovered one of these limbless Batrachians.

The *Fauna of British India* gives the distribution as follows :—

'Java, Borneo, Singapore, Sikkim and Western Ghats of India; specimens were obtained in Malabar by Col. Beddome and I have recently received from Mr. Gleadow a fine specimen obtained at Waghei, Surat.'

As there is no definite locality mentioned for the Western Ghats, I think it is worth while recording this animal from a particular spot in order to enable us to further our knowledge of its distribution.

Bombay Natural History Society,
6, Appollo Street, Bombay.
September 29, 1926.

C. McCANN.

No. XVIII.—VIVIPARITY IN A THISTLE

(*With a plate*)

In July 1925 Mr. D. Frenchman found a specimen of *Echinops echinatus*, Roxb., a thistle, two miles from Panchgani on the way to Wai. This plant usually flowers from November to January and ripens its fruit immediately after.

The specimen in question was a plant of the previous year; stem and leaves were absolutely dead and dry, so were the vegetative parts of the inflorescence. From between the bracts about twenty achenes had germinated and young plants with a short stem and branches and roots had developed. The first leaves were 3-4 cm. long and about 1 cm. broad; petiole and blade were of equal length. It is strange that the seeds had not fallen off during the long season.

I may mention another point. *Echinops echinatus* is always described as an annual. Our specimen had produced a new stem at the base of the old one which shows that there are plants which are at least biennial.

PANCHGANI, E. BLATTER.
October, 1926.

No. XIX.—THE USE OF PATENT BULLETS IN SHOT GUNS

The following notes regarding patent bullets that can be fired from both choke and cylinder barrels might be found useful by young shikaris who are at present more or less dependent for guidance regarding their choice in such matters on the advertisements and price lists of the various firms of gun makers :—

The principal patent bullets now in the market are :—

1. The Lethal.
2. The Destructive.
3. The Destructor.
4. The Contractile.
5. The Rotax.
6. The Rotary.

There are some others besides the above, but the six named are the chief ones now in use and are generally available in most towns and stations where there is a reputable arms and ammunition vendor.

Lethal Bullets.—These are effective against all big game except against such thick-skinned and heavy-boned animals as elephants, rhinos and buffaloes. They have been also used with success against bison. I have had extensive experience of this type of bullets, having used them since their first appearance in the market, and I can unhesitatingly recommend them as one of the best, if not *the* best of the patent bullets manufactured. I have bagged over fifty animals with these bullets and though they included such tough beasts as bears, sambar, etc., generally one shot has been sufficient, when well placed, to account for the biggest of them. The maximum range of these bullets when fired from an ordinary 2½″ 12-bore case is about 100 yards, and about 120 to 130 yards when used with the 3″ or 3¼″ 12-bore case. They are also available for 16 and 20-bore guns, and these smaller bores are also quite effective up to about one hundred yards, though of course inferior in power to the 12-bore. With the ordinary 12-bore gun (choke or cylinder) they are as accurate as a first class express rifle up to some 80 yards and they are ideal for snap-shots in the jungle where the shooting is generally done at very close ranges. These bullets can be used with perfect safety from both choke and cylinder barrels and possess considerable penetration besides readily expanding on striking a bone or a mass of muscles, etc., such as the shoulder of a tiger or a big bear. The lethal bullet has been extensively used by many eminent sportsmen and it can be safely recommended to the novice.

Destructive Bullets.—This is another spherical bullet specially made for use in both choke and cylinder guns. I have not had much experience of these bullets, but a friend of mine who has had considerable experience of these found that though they were quite as accurate as any other patent bullet up to some 100 yards, they were rather inclined to expand too much and so lessen penetration. The bullet is suitable for use from both choke and cylinder barrels and is quite suitable for use against soft skinned animals.

Destructor Bullets.—These are similar to the above and suitable for use with both choke and cylinder guns. I had occasion to try it last year when I was in the Kamrup District and fired some twenty rounds in all including four or five shots at a target. I found them quite accurate up to about 100 yards and bagged several deer and a small bear with them. They expanded very well on striking an animal but left me with a doubt as to whether their penetrative powers would be sufficient to deal with such animals as tigers, etc., as I got an impression from examining the animals shot by me that they might not be able to go through the tough muscles, etc., of a tiger's shoulder and so fail to reach a vital part. This and the preceding type of bullets are only available for 12-bore guns.

Contractile Bullets.—This is another good bullet. From the way they are made they expand readily and have considerable penetration. I shot a big wild boar, at a range of some 40 yards with one of these bullets when I was in the Cachar District, and the bullet which struck the animal on the right shoulder broke both shoulders and caused a wound which would have brought down any beast however big. This bullet also accounted for a large panther which one of my friends killed with one shot in the chest. The bullet, which had expanded beautifully, was found near the root of the tail having raked the animal right through. The contractile bullet can be safely fired from both choke and cylinder barrels and it is one of the best patent bullets in the market. Their effective range is about the same as that of the lethal bullet and I think this is one of the bullets that can be safely recommended to the young shikari as a suitable one for everyday use. At present they are available in 12-bore only, but I believe the manufacturers contemplate turning them out for use in 16 and 20-bore guns in the near future.

Rotax Bullets.—These bullets have only recently appeared in the market but they are well spoken of by those who have used them. I have however unfortunately no practical experience of them. Recently in some letters published by Messrs. R. B. Rodda & Co. (the manufacturers of the Rotax bullets), in their catalogue it was stated that tigers were shot with the Rotax bullets at ranges well over 150 yards. I accordingly made a reference to the firm and inquired whether they could recommend their Rotax bullets as likely to be effective at ranges of 150 or over when fired from a 12-bore gun. The firm in reply said that ordinarily the effective range of the Rotax bullet is about 100 yards when fired from a 2½″ 12-bore case and about 30 yards more when fired from a 3″ or 3¼″ 12-bore case. Accordingly the stories of animals having been bagged at such long ranges as 150 yards and over should be considered as flukes and the effective range of the Rotax bullet is about the same as that of any other patent bullet. The Rotax can be used with perfect safety from both choke and cylinder barrels.

Rotary Bullets.—This bullet was very much in evidence at one time but their popularity appears to be on the wane. I have had no experience of these bullets myself, but a Gurkha officer (retired) who used these bullets exclusively for some time for shooting big game, told me that they were quite satisfactory ordinarily but that on one or two occasions he found that they struck the target sidewise and did not travel end on as they should. He used them from an American made single 12-bore gun fully choked and said that he found the bullet quite accurate to about 100 yards or so and that they were very effective against deer and wild pigs.

In conclusion it may be seen from the above that the effective maximum range of all the patent bullets is about 100 yards or so when used with the ordinary 12-bore 2½″ cartridge and some 25 to 30 yards more when used with the 12-bore long range 3″ and 3¼″ cartridge cases and all stories about animals, especially big beasts having been shot at ranges over a 100 yards with any of the bullets mentioned above should be considered in the nature of flukes and the young shikari would find it advantageous to do his shooting at ranges of 80 yards or less with whatever patent bullet he may select for use.

UPPER SHILLONG,
ASSAM, E. L. McCULLOCH.
November 23, 1926.

[We publish the following comments by Col. R. W. G. Burton, on the use of patent bullets from smooth bore guns, from which it will be seen that he holds a different view from Mr. McCulloch's as regards the efficacy of these missiles. The subject is an interesting one and of real importance to the novice just beginning his shooting career, and we would welcome the opinions and experiences of other sportsmen.

Col. Burton writes :—

'Mr. McCulloch of Shillong writes regarding statements in gunmakers' catalogues as to shooting powers of ordinary smooth bore guns with various patent bullets.

'I have not an extensive personal knowledge of the behaviour of such bullets having always used a rifle and avoided bullets with a shot gun. I give however, such experience as I have for what it is worth.

'The *"Lethal"* bullet—a tiger shot at by a friend—distance 30 yards hit on muscles of left shoulder : Some days later this tiger shot over a kill—the lethal bullet found sticking in muscles of the shoulder like a plum in a pudding! a mere flesh wound—no penetration.

'A Sambhur shot by myself: an expanded lethal bullet was just under the skin.

'A tiger—killed from machan by my nephew this year—10 yards.

'I am afraid this is but little, but it is instructive. I am convinced from a large experience of shooting with a rifle that the various patent bullets can be of no use outside quite short ranges—say anything up to 25 or 30 yards, not beyond that, and then only against lighter animals. Even at 30 yards such heavy animals as tiger and sambhur, if hit on the massive muscles of the shoulder—are likely to receive a small amount of damage.' EDS.]

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